A PROFESSIONAL MANPOWER BULLETIN

ENGINEERING AND SCIENTIFIC MANPOWER RESOURCES IN CANADA

Their Earnings, Employment and Education, 1959

BULLETIN No. 9

MARCH 1961

ECONOMICS AND RESEARCH BRANCH
DEPARTMENT OF LABOUR
OTTAWA

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in Canada:

Their Earnings,
Employment and Education, 1959

Professional Manpower Bulletin No. 9

ECONOMICS AND RESEARCH BRANCH
DEPARTMENT OF LABOUR, OTTAWA
March 1961

Hon. Michael Starr
Minister

G.V. Haythorne
Deputy Minister

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FOREWORD

This report is one of a series prepared by the Manpower Resources Division of the Economics and Research Branch of the Department of Labour. The data for the study were obtained from the regular annual survey of a one-third sample of the scientific and technical personnel in the Register of the Department of Labour.

The purpose of the report is to analyze certain characteristics of those engineering and scientific persons in the Register, in particular their earnings, employment and education.

A preliminary release of the findings of the survey was made in May 1960.

The report was prepared by Mr. A.D. Boyd under the supervision of Mr. P.H. Casselman and the direction of Mr. J.P. Francis. Mr. D. Campbell prepared Appendix 3, an analysis of the non-respondents to the survey.

Mr. H.R. Woods gave valuable help on various aspects of the project. The assistance of the engineers and scientists who provided the information on which this study is based is also gratefully acknowledged.

W.R. Dymond,
Director,
Economics and Research Branch,
Department of Labour.

TABLE OF CONTENTS

Cont'd...

TABLE OF CONTENTS (Concl'd.)

LIST OF TEXT TABLES

LIST OF APPENDIX TABLES

Cont'd. . .

LIST OF APPENDIX TABLES (Concl'd.)

INTRODUCTION

Who are included in the survey?

This publication is based on data obtained from a survey of a one-third sample of the professional people who are included in the Register of Scientific and Technical Personnel maintained by the Federal Department of Labour. The data for the present survey relate to the calendar year 1959 and were collected between November 1959 and March 1960. A preliminary report on the survey results was released in May 1960. The survey covered close to 23,000 out of the approximately 75,000 people included in the Register.

The Register includes all persons in engineering, science, architecture, and veterinary science who are Canadian citizens or non-Canadians working in Canada. These persons must be either graduates of a university course in engineering, science, architecture, veterinary medicine or must have passed qualifying examinations set by the registering body in the profession.

This survey is the fourth in a series of annual surveys which began in 1957 under which one-third of these professional persons in the Register are surveyed each year. The results of the second annual survey in this series were published as Professional Manpower Bulletin No. 7, **Engineering and Scientific Manpower Resources in Canada: Their Earnings, Employment and Education, 1957,** June, 1959. The data obtained in the third annual survey made in 1958 were not published in the Professional Manpower Bulletin series but were circulated in the form of a preliminary release of tabulations printed in August 1959.

The procedure followed in these surveys was to divide the universe consisting of those in the Register into three equal parts so that each part was representative of the whole. Each year, questionnaires are sent to those in one of the three parts which means that all are covered in a three-year period.[1]

In this way, the Department through the Register maintains individual records of most of the nation's scientific and technical personnel which include data such as earnings, employment, education, experience and location. These records provide a unique and valuable source of information on this important part of the nation's manpower resources.

In the present survey, the cut-off date for inclusion of information from the respondents was March 3, 1960. At that date 16,991 out of a total of 22,782 or almost 75 per cent of the questionnaires mailed out were returned. Close to 1,700 could not be delivered. Over 80 per cent of those who presumably received a questionnaire actually replied.

The number of questionnaires received totalled 16,991. Of these, 382 were initially removed representing mainly those who gave insufficient

[1] For further details on the history and operations of the Register, see Appendix 1 in this report.

96362—3

information in their replies or who were ordinarily excluded from the survey operations because of death or transfer to a non-engineering or a non-scientific profession. Other groups removed from the tables in this report include 401 who took no university course; 287 non-Canadian citizens working outside Canada; 699 Canadian citizens who were working outside Canada; 806 non-members of the labour force; and 49 unemployed.

In this way, 2,624 out of 16,991 were removed leaving a residual of 14,367 scientific and technical personnel who were utilized in the tables in this report, representing that proportion of the nation's engineering and scientific manpower resources who were part of the Canadian labour force during the calendar year 1959. **The actual number of such persons in the labour force was of course much larger than the number shown here since the survey itself is based on a one-third sample of engineering and scientific personnel.** It should also be noted that the 14,367 figure as well as the components on which it is based may vary from one tabulation to another depending on the particular groups included in or removed from a particular tabulation.

What type of information is provided in this report?

The 14,367 persons covered in this bulletin were in engineering specialties; architecture; veterinary medicine; and the following science specialties: agriculture; biology; chemistry; forestry; general science; geography; geology; mathematics; mathematics and physics; physics, and other sciences. In terms of university degree obtained, the number of engineers comprised 60 per cent of this total, those with science degrees 34 per cent, and architecture and veterinary medicine about 3 per cent each. By field of employment specialization, engineers comprised 57 per cent of the total, science including agriculture, forestry and geography 36 per cent, architecture 4 per cent, and veterinary medicine 3 per cent.

In the majority of cases where the data are arranged by field of specialization, these terms refer to field of undergraduate academic specialization at university. In a few tables, the principal field of employment specialization is used and in these cases this change is indicated. It should be noted that this represents a change in approach from that used in Bulletin No. 7 where the basic specialty breakdown was field of employment specialization. In the present report both types of specialty are given in some cases in order to permit easier comparison with Bulletin No. 7. The effect of this change in arrangement is somewhat minimized by the rather close association in most cases between field of study and field of employment. But in the case of individual specialties there are substantial differences. It was thought that the arrangement by academic course specialty would provide greater opportunities for a career type analysis of the data by permitting closer comparisons of earnings and employment data with earlier academic background.[1]

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[1] See Appendix 2 for further details.

In addition to the terms "engineer" and "scientist" which may refer either to employment or to academic background, there are other terms used in this report which have a special meaning. The term "function" is based on a list of ten of the most important areas of job activity. The respondents, as in the case of field of employment specialization, selected their function on the basis of a list provided on the questionnaire. "Level of education" is based on the highest level of education including the highest academic degree obtained. The classifications are broken down into those who obtained no degree, bachelor's, master's, or a doctor's degree.[4]

The data on earnings relate to professional income earned in the calendar year 1959 and exclude the earnings of respondents who worked less than 10 months or who were employed on a part-time basis. "Earnings" data represent annual earnings including salary, commissions, bonuses, etc., of those who either worked for an employer or were self-employed in their own businesses. This represents a slight change from the data in Bulletin No. 7 based on "salaries" which excluded the earnings of those who were self-employed. However, some tables have been included in this bulletin which compare earnings of self-employed with those who are working for an employer.

"Other professional income" data include the earnings of those engaged in professional activity outside their regular employment. A good example are university teachers who are engaged by private industry or government in consulting work.

Information on earnings was supplied by 98 per cent of the respondents who worked full-time and more than 10 months during the year.

In order to permit easier comparison with Bulletin No. 7, the data in this report are arranged in the same general order. The four chapters deal with earnings, employment, the relation between education and employment, and education respectively. However, the order of the data does not correspond exactly because some tables in Bulletin No. 7 have not been duplicated here, and some new information has been added. Because of these changes and those mentioned earlier – the change in specialty from employment to academic course in some cases and the inclusion of the self-employed in earnings tabulations – comparison with data in Bulletin No. 7 should be made with care.

One additional change made in the tabulations in this survey should be mentioned. Those who did not specify a field of employment specialization were naturally not included in tabulations used in Professional Manpower Bulletin No. 7 based as they were mainly on field of employment specialization. The change in the present report from a breakdown based on field of employment to one based chiefly on academic course meant that about 1,750 respondents who did not specify a field of employment specialization were included in all tables based on academic course. But

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[4] See Appendix 2 for an explanation of educational groupings.

96362—3½

where the tables in this report were based on field of employment specialization, those who did not specify that they were working in a field of employment specialization were excluded. These latter tables are therefore more closely comparable to those in Professional Manpower Bulletin No. 7.

Table 1 – Results of Survey Operations, 1957, 1958, 1959

	1957	1958	1959
(a) Total mailed	21,033	24,887	22,782
(b) Returned as moved	3,376	3,134	1,689
(c) Assumed delivered	17,657	21,753	21,093
(d) Not returned	4,389	4,665	4,102
(e) Replies received	13,268	17,088	16,991
(f) Per cent response (of total mailed) e/a	63	68.7	75
(g) Per cent non-response (moved) b/a	16	12.6	7
(h) Per cent non-response (not returned) d/a	21	18.7	18

In common with previous surveys, the data here have certain limitations. The survey itself is based on a one-third sample of the universe and the results are subject to some degree of sampling error. In some cases the breakdowns of factors in the tables have produced low totals and where feasible, broader groupings have been made. It is therefore recommended that the reader study mainly the general patterns which emerge.

Table 1 gives a brief summary of the last three survey operations. Since the survey is of individuals, the number of non-respondents is usually numerous. The non-respondents are of two types: those to whom the questionnaire was not delivered by the post office because the addresses of these persons were out of date, and those who apparently received questionnaires but who did not reply. The proportion of all non-respondents declined from 37 per cent in the 1957 survey to 25 per cent in the present 1959 survey. Those to whom questionnaires were not delivered declined most of all from 16 per cent in 1957 to 7 per cent in 1959. Those who were reached but who did not reply also declined somewhat, from 21 per cent to 18 per cent.

Non-respondents may bias the survey results because they may have characteristics which differ from those who do reply. If this is true, it could be said that if they were included the results of the survey would be different. A special study of a 25 per cent sample of the non-respondents to the 1958 survey was undertaken in order to determine more precisely the characteristics of this group and to assess the effect of the lack of response on the over-all results of the survey. The conclusion reached as a result of this special study is that in view of the statistical procedures followed in the survey, the absence of the non-response

group in the survey tabulations did not appreciably affect the validity of the data.[1]

A final caveat should be offered concerning the universe of scientific and technical professionals. The total population of scientific and technical persons in Canada is not known precisely and it is possible that the Register maintained by the Department of Labour may not cover all. Efforts are continuing to complete the coverage of the survey by the additions of new groups and new names. A reduction in size and a more precise delineation of the characteristics of the non-response group having been made, it is now felt that despite some limitations, this survey is providing increasingly reliable and useful data on the characteristics of scientific and technical professionals in Canada.

What are some of the highlights based on the survey data?

Median earnings for those in engineering with bachelor's degrees ranged from $5,900 for those 1–5 years from bachelor graduation to $11,900 for those 31–35 years from bachelor graduation. For scientists with bachelor's degrees, earnings for the same experience groups ranged from $5,250 to $8,350.

Earnings of engineers at the post-graduate level with 26–30 years of experience rose 24 per cent between 1957 and 1959.

For scientists, the private industry versus government earnings differential increased from $550 per year for those who graduated over the last ten years to $2,400 per year for those who graduated 31–40 years ago.

Engineers and scientists doing executive and administrative work earned most, with median earnings of $10,700 and $9,150 respectively at all experience levels taken together.

Graduates in mining engineering and architecture had highest and second highest earnings respectively, $9,350 and $8,850.

For scientists, earnings were highest in Ontario at $7,550 and lowest in the Atlantic region, $6,200.

As a group, males in science earned $7,150 and females $4,700.

In engineering, the earnings of the self-employed as a group were $2,750 higher per year than the earnings of those who worked for an employer.

Eighty per cent of the engineers and 47 per cent of the scientists were employed in private industry; seventeen per cent of the engineers and 33 per cent of the scientists were employed by governments; nine per

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[1] See Appendix 3 for a summary of the results of the special study of non-respondents to the 1958 survey of scientific and technical professionals.

cent of the engineers and 20 per cent of those in science worked for the Dominion Government; universities employed two per cent of the engineers and 9 per cent of those in science, while one per cent of the engineers and 11 per cent of the scientists worked for high schools.

Twenty-three per cent of science graduates were doing research and development work, and about 29 per cent of the engineers were doing executive and administrative work.

While only 6 per cent of all scientists are women, 22 per cent of scientists in biological sciences are women.

About 29 per cent of scientific and technical professionals worked in fields of employment specialization different from the academic courses they followed on the undergraduate level.

Roughly one out of three engineers and scientists who were educated and employed in Canada were employed outside the province where they received their undergraduate education.

Eight per cent of the engineers held master's degrees and 1 per cent held doctor's degrees. For scientists, (excluding agriculture and forestry scientists), 18 per cent held master's and 24 per cent held doctor's degrees.

About one-third of the Canadian-born scientists had master's or doctor's degrees compared to one-half of the scientists who were born in countries other than Canada, the United Kingdom or the United States.

About 84 per cent of the scientists employed by universities held master's or doctor's degrees compared to 55 per cent of scientists employed by the federal government who held similar advanced degrees.

Chapter 1 – EARNINGS

Earnings data on scientific and technical professionals are given in Figures 1 to 10 and in Tables 2, 3, and A–1 to A–14.

How do earnings of engineers and scientists vary with length of experience and level of education?

Earnings of engineers and scientists in 1959 according to number of years since graduation as given in Table A–1[1], show a pattern rather similar to that indicated in Professional Manpower Bulletin No. 7. These data for 1959 are shown visually in Figure 1[2].

The earnings of engineers move upward steeply when groups with little experience are compared to those with 11–15 years of experience since their bachelor degree. For scientists, the pattern is similar but slightly less pronounced with a less rapid earnings rise from groups with little experience to those 11–15 years from bachelor graduation.

A comparison of the 1959 earnings of engineers and scientists, taking the bachelor and postgraduate degree holders as a group, reveals that the spread in engineers' earnings according to years since graduation is greater than that for scientists. The engineering group with 31–35 years of experience earned $11,900 – 100 per cent more than those with only 1–5 years of experience whose median earnings were $5,950. Scientists with 26–30 years of experience enjoyed peak earnings – $9,000 – which, however, were only 58 per cent above earnings of those with 1–5 years of experience – $5,350. There is more flattening out in the earnings trend at the upper experience levels for scientists than for engineers.

A comparison of the absolute differences in earnings of engineers with 11–15 and those 31–35 years from bachelor graduation reveals a difference of $2,800. Scientists with peak earnings, those with 26–30 years of experience, earned only $1,250 more than those at the 11–15 level. In percentage terms, engineers with 31–35 years of experience earned 31 per cent more than those at the 11–15 year level. Scientists at the peak level of earnings – the 26–30 year group – earned only 18 per cent more than those at the 11–15 year level. In short, earnings of engineers exhibited a broader and higher range at the upper experience levels than the earnings of those in science.

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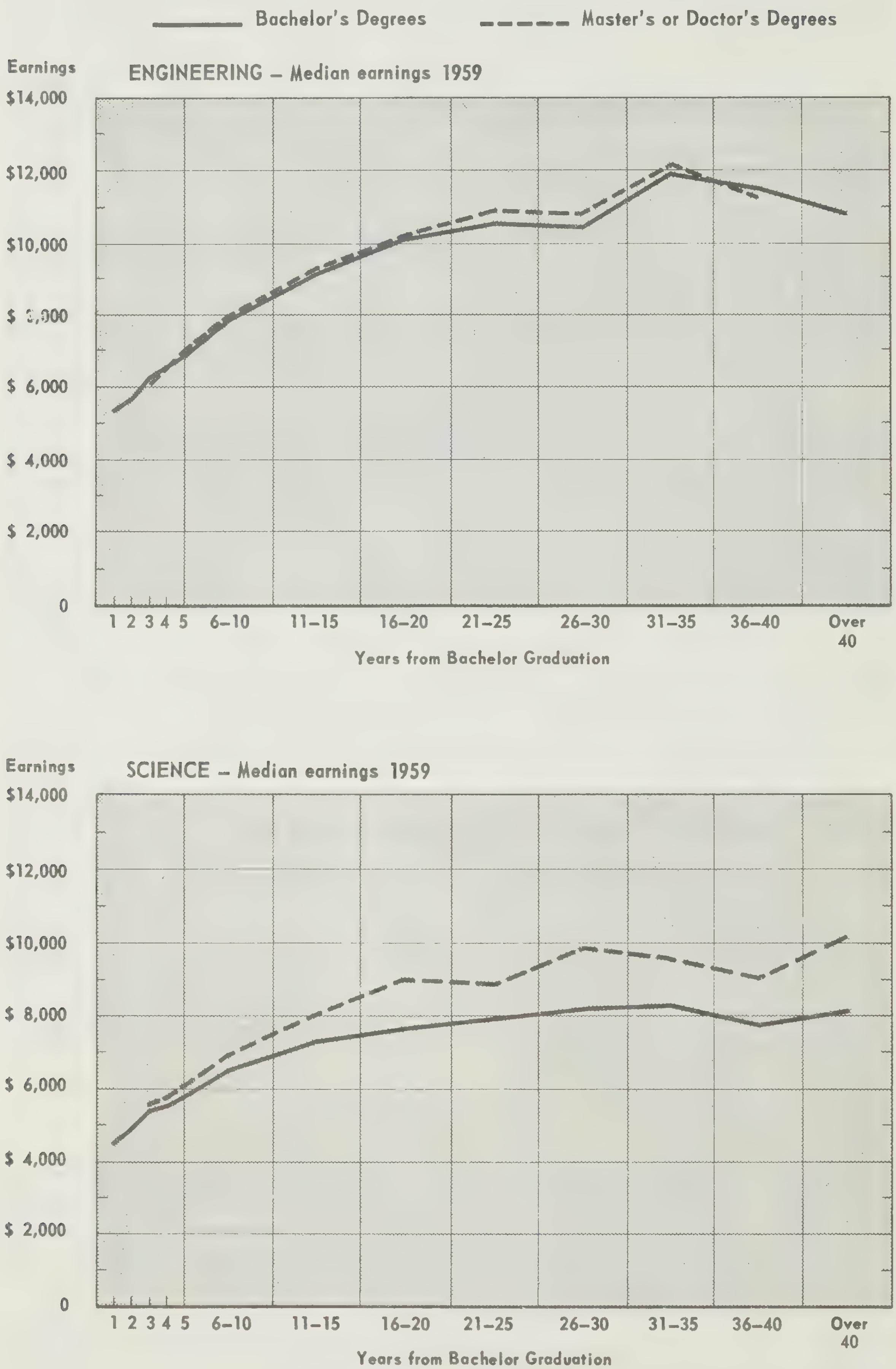
1 This table is not directly comparable to Table 1 in Professional Manpower Bulletin No. 7. In Table A–1 in this publication, the terms "engineer" and "scientists" refer to those whose academic course was engineering or science whereas in Professional Manpower Bulletin No. 7, these terms referred to field of employment specialization. For a more direct comparison with Table 1 in Bulletin No. 7 see Table A–2 in this report.

2 This trend is in terms of experience at a point of time and does not purport to illustrate the earnings pattern of engineers and scientists during their lifetimes. To show a lifetime or career pattern of earnings, data would be required on the same group of individuals over a period of time.

Figure 1

HOW DO EARNINGS IN ENGINEERING AND SCIENCE VARY WITH LENGTH OF EXPERIENCE AND LEVEL OF EDUCATION?



Source: Table A–1

Engineers and scientists with masters and doctors degrees as a group had higher median earnings than those with bachelor's degrees, but the differential was greater in the case of scientists than for engineers. Engineers with advanced degrees as a group earned $600 more in 1959 than those with bachelor's degrees while the annual earnings of scientists with advanced degrees were $1,250 above those with only bachelor's degrees.

In the case of engineers, the bachelor – postgraduate pattern shown by the 1959 data was different from that shown in Table 1 in Professional Manpower Bulletin No. 7 where the 1957 earnings of engineers with advanced degrees were on the same level as bachelors for the first fifteen or so years of experience but dropped below bachelor earnings beyond the 15 year experience level. In the current table, earnings of engineers with advanced degrees are narrowly above the earnings of those with bachelor's degrees, for those with less than 36 years of experience beyond the bachelor degree. This pattern agrees closely with the data obtained from the 1958 survey results.[1]

To what extent have earnings of engineers and scientists increased between 1957 and 1959?

Figure 2 and Table 2, based on Table A–3, compare the earnings of engineers and scientists for the calendar years 1957 and 1959.

The most striking increases in earnings occurred among those with graduate degrees. Earnings of engineers with postgraduate degrees rose 6.1 per cent but earnings of engineers with bachelor's degrees rose only 4.5 per cent between 1957 and 1959. Engineers with more than 20 years of experience and with master's or doctor's degrees had a larger relative and absolute increase in earnings than those in science with similar experience and education. For example, earnings of engineers with graduate degrees and with 26–30 years of experience rose 24 per cent between 1957 and 1959, from $8,950 to $11,100.

For scientists, the earnings differential between 1957 and 1959 was of a magnitude comparable to that for engineers, but the variation between bachelor and postgraduate degree groups and between those at lower and higher experience levels was less evident. Earnings of scientists with bachelor's degrees at the 1–5 year experience level rose 9.2 per cent, from $4,900 to $5,350, while earnings of those with 26–30 years of experience rose 16.7 per cent, from $7,200 to $8,400. But earnings of scientists with postgraduate degrees rose only 6.3 per cent compared to a 7.1 per cent rise in earnings of scientists with bachelor's degrees.

The sharp increase between 1957 and 1959 in the earnings of engineers holding advanced degrees who graduated more than 20 years ago appears to be a labour market phenomenon. It does not seem to be associated with

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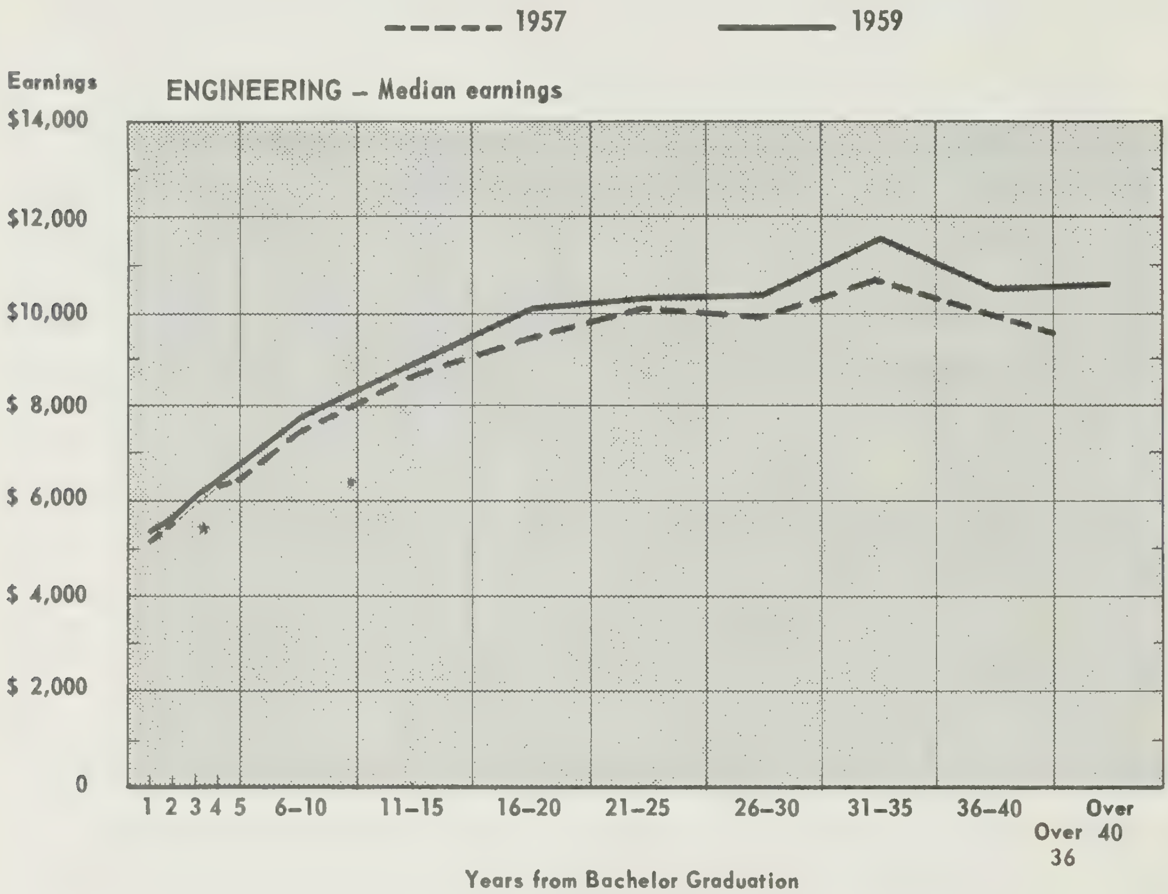
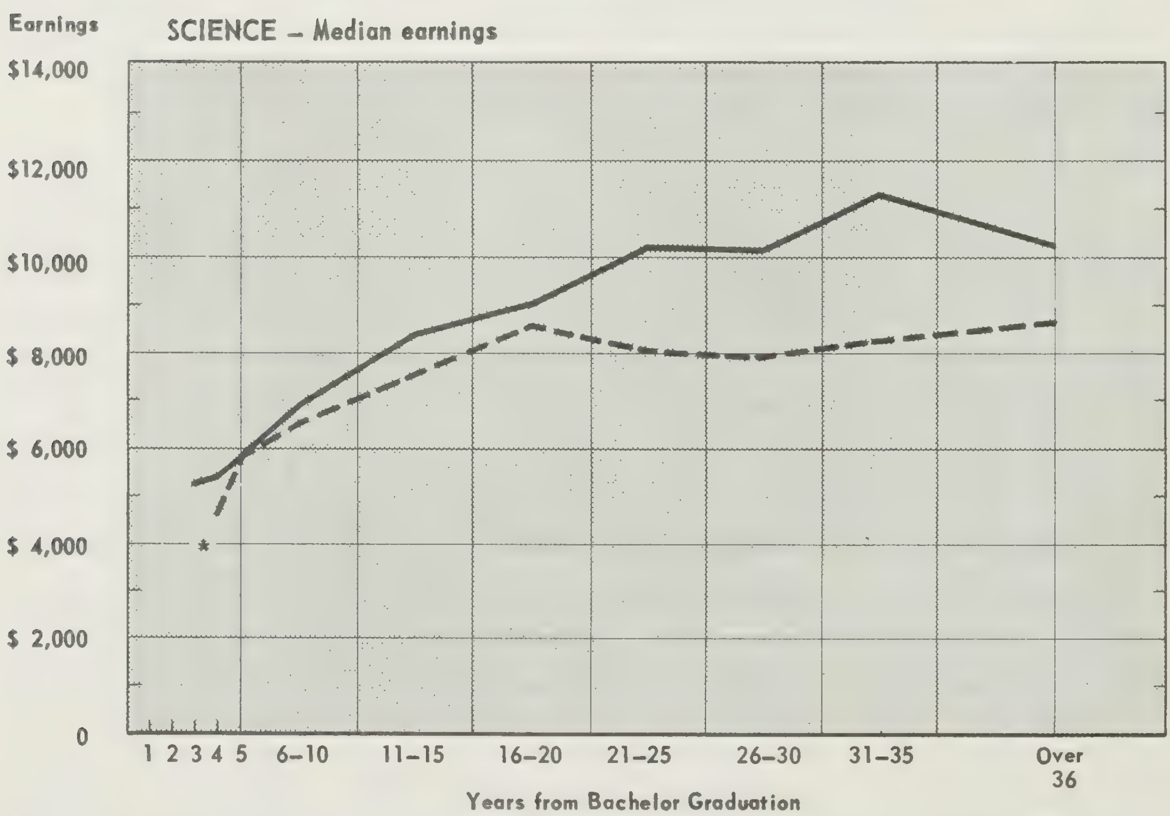
[1] See **Engineering and Scientific Manpower Resources in Canada: Their Earnings, Employment, and Education, 1958,** Preliminary Release of Tabulations, Economics and Research Branch, Department of Labour, Ottawa, August 1959.

Figure 2

TO WHAT EXTENT HAVE EARNINGS IN ENGINEERING AND SCIENCE OF THOSE WITH BACHELOR'S DEGREES INCREASED BETWEEN 1957 AND 1959.





Source: Table A–3

** Graduates of 1954 not included in the 1957 survey.*

Table 2 – Percentage Increase in Median Earnings in Engineering and Science by Years from Bachelor Graduation and Level of Education, 1957 and 1959

Years from Bachelor Graduation	Earnings, Level of Education, 1957 and 1959					
	Engineering					
	Bachelors			Masters and Doctors		
	1957	1959	% Increase, 1957-1959	1957	1959	% Increase, 1957-1959
	$	$	%	$	$	%
1........	5,200	5,400	3.8	–	–	–
1–5	5,700	5,900	3.5	5,950	6,400	7.6
11–15	8,650	8,950	3.5	8,600	9,450	9.9
21–25........	10,150	10,300	1.5	9,050	11,250	24.3
26–30	9,900	10,350	4.5	8,950	11,100	24.0
31–35	10,750	11,500	7.0	9,300	12,300	32.3
All years.....	7,800	8,150	4.5	8,250	8,750	6.1

Science

1........	4,600	4,750	3.3	–	–	–
1–5	4,900	5,350	9.2	5,100	5,750	12.7
11–15........	6,800	7,500	10.3	7,450	7,950	6.7
21–25........	7,600	7,750	2.0	8,050	8,950	11.2
26–30	7,200	8,400	16.7	8,550	9,900	15.8
31–35	8,250	8,000	-3.0	8,800	9,500	8.0
All years.....	6,300	6,750	7.1	7,200	7,650	6.3

Source: Surveys of Scientific and Technical Personnel, 1957 and 1959.

96362–4½

any differences in the industry or job structure deployment of the engineers and scientists covered in the two surveys. In other words, those in the 1959 survey do not appear to be in higher-paying jobs or industries to any significantly greater degree than was the case in the 1957 survey.

Since no significant difference in job or industry structure occurred for more experienced engineers with master's or doctor's degrees in the 1957 survey as compared with the 1959 survey the larger increases in the earnings of this group between 1957 and 1959 must have been the result of other influences impinging on the labour market. The more rapid rise in earnings of post-graduate degree engineers compared to engineers with bachelor's degrees may be partly explained by the larger proportion of engineers with master's or doctor's degrees employed by universities, 13 per cent compared to 1 per cent of those with bachelor's degrees. The large increases in university salaries in recent years would have more effect on the earnings of those with master's and doctor's degrees since they are more heavily concentrated in universities.

But the large increases in earnings of engineers who have a considerable amount of experience may be due to a quite different factor. The sharp rise in starting salaries of engineers during the years of rapidly increasing demand for engineers, 1955–57, was not sustained for this group between 1957 and 1959. The later increase in the earnings of engineers with over ten years of experience during the same period was probably the result of this 1955–57 rise in starting salaries being transmitted later to the higher echelons of the earnings structure. The possibility of a lag between increases in earnings of engineers and scientists with little experience and increases in earnings for those with more experience has been speculated upon by Arrow and Capron.[1]

The extent of the changes in earnings of engineers and scientists with master's or doctor's degrees in both the 1957 and 1959 surveys are probably subject to more than the average amount of possible error owing to the small numbers of cases on which they are based, especially in the instance of engineers with advanced degrees.

With what kinds of employers are the earnings of engineers and scientists highest?

Figure 3, based on Table A–4, indicates that engineers in the private sector of the economy, professional service and private industry, earned more on the average in 1959 than those in the other sectors. Those employed by universities were in general next highest, and those employed by governments and high schools lowest.

Scientists in the professional service sector earned most in 1959 and those in universities were next in line, followed by private industry, high schools, and government in that order. The most noticeable change

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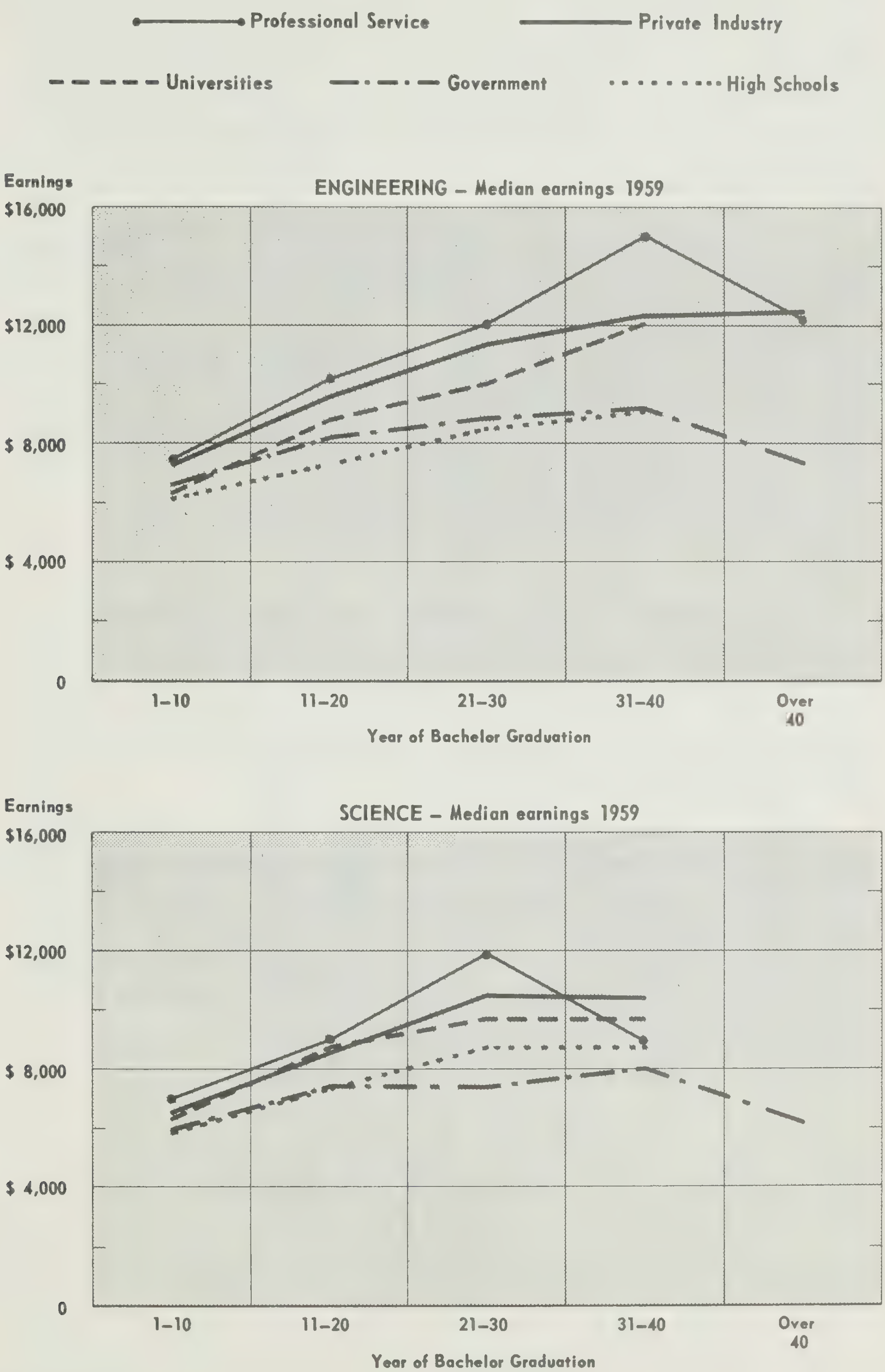
[1] Arrow, Kenneth J., and William M. Capron, "Dynamic Shortages and Price Rises: The Engineer – Scientist Case", *Quarterly Journal of Economics*, May, 1959.

Figure 3

WITH WHAT KIND OF EMPLOYERS ARE EARNINGS IN ENGINEERING AND SCIENCE HIGHEST?



Source: Table A–4

from the 1957 pattern shown in Bulletin No. 7 was the increase in the earnings of those employed in universities relative to all other groups. Scientists in universities are shown as having median earnings in 1959 $850 higher than those in industry. It may be noted that despite this, total median earnings of scientists in universities were below those of scientists in industry at all levels of experience, except for those with 11–20 years of experience where a proportionately large number of scientists in universities were concentrated. In contrast, a relatively large proportion of scientists in industry were in the 1–10 year experience category where earnings were lowest. This resulted in an upward push to the total earnings figures for scientists in universities and a downward bias for earnings of those in private industry.

As in Bulletin No. 7, the earnings differential in 1959 between engineers and scientists employed by high and by lower paying employers tended to widen as experience increased.

For engineers, the private industry-government differential widens from $700 in the case of those who graduated in the last 10 years to over $3,100 for those who graduated 31–40 years ago. For scientists, the private industry-government differential for the same experience groups widens from $550 to $2,400 per year.

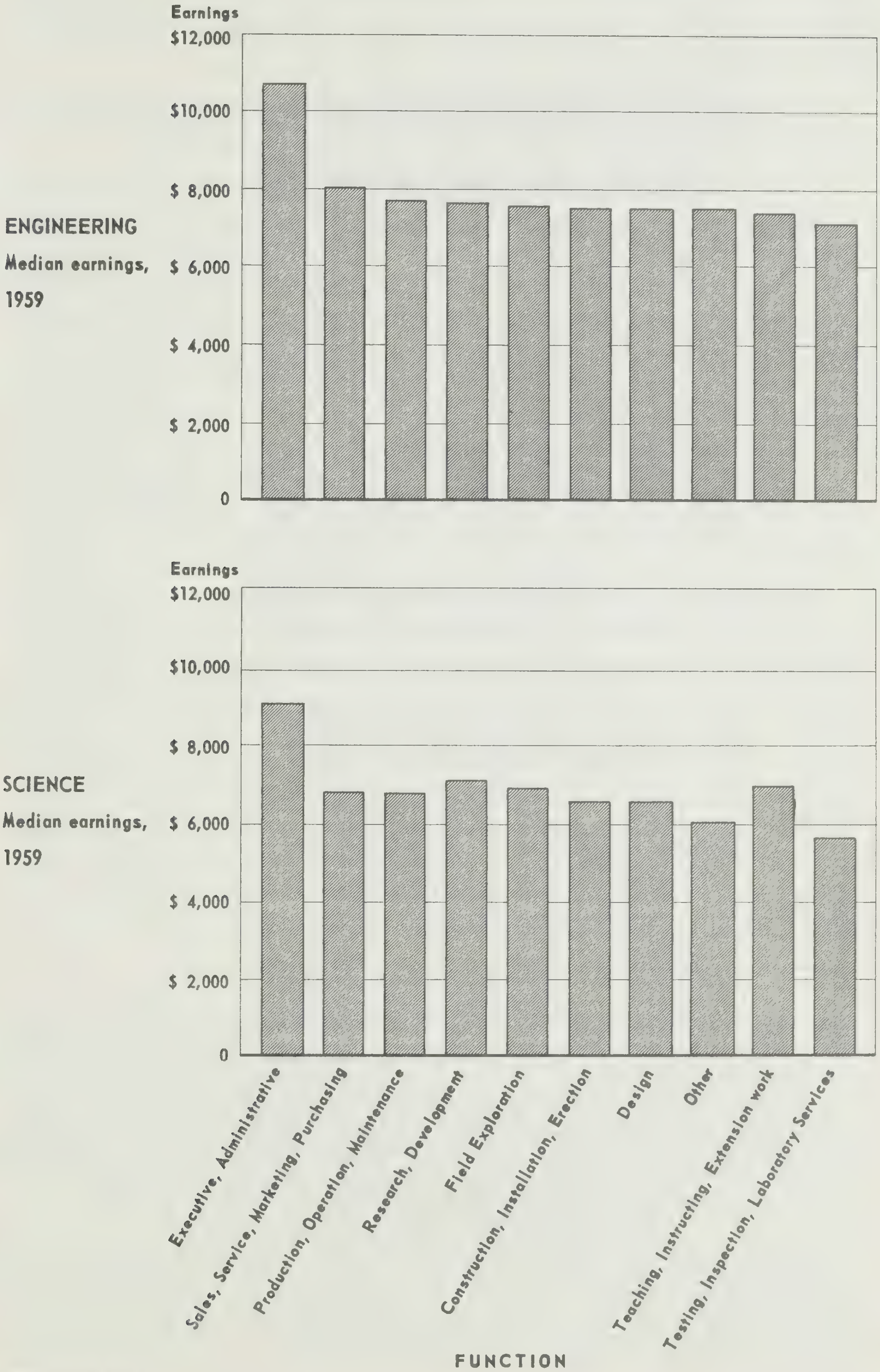
In which types of jobs are earnings of engineers and scientists highest?

Figure 4 and table A–5 indicate that for both engineers and scientists, those in the executive and administrative function earned most in 1959, $10,700 and $9,150 for engineers and scientists respectively. In cases where numbers reported were large enough to be meaningful, "testing, inspection and laboratory services" was the function with lowest earnings for both engineers and scientists.

Engineers in both 1957 and 1959 had a broader and higher earnings range than scientists. In the executive and administrative function the 1959 spread from lowest to highest experienced groups was $7,150 in engineering and $5,150 in science. Scientists in teaching showed a marked change in 1959 from that of 1957, rising from among the lowest paying functions to third highest. This undoubtedly reflects the substantial university salary increases in the recent past.

Figure 4

IN WHICH TYPES OF JOBS ARE EARNINGS IN ENGINEERING AND SCIENCE HIGHEST?



Source: Table A–5

How do the earnings in the various engineering and scientific fields compare?[1]

In 1959, earnings of engineers shown in Figure 5 and Table A–6 were, on the average, $650 higher than earnings of those in science, $8,250 compared to $7,600. The low to high earnings range among the engineering fields was $2,150, from $7,200 for forest engineering to $9,350 for mining engineering. In science, the corresponding range was $2,000, from general science at $6,450 to geology at $8,450.

Graduates in mining engineering and architecture had highest and second highest earnings respectively – $9,350 and $8,850.[2]

The arrangement of the data by year of bachelor graduation permits examination of the earnings by field of specialization in terms of another dimension – experience. Some changes of position occurred among the various specialties when years from bachelor graduation are considered. For example, mining engineering relinquishes first place to other specialties for all except the group who graduated 21–30 years ago. This suggests that the high position of mining engineering earnings results to a large degree from the fact that they are an older and more experienced group than those in other specialties. In fact, the median age of mining engineers is 44, compared to 37 for other engineering specialties as a whole. Increased experience is strongly associated in all cases with higher earnings.

The high position of geologists' earnings relative to other science specialties (excluding agriculture and forestry) here, as in Professional Manpower Bulletin No. 7, may be related in part to the slightly higher proportion of geology graduates employed in geology who are in the lucrative executive and administrative function – 16 per cent versus 12 per cent for scientists as a whole (excluding agriculture and forestry). Besides, a low proportion of geology graduates are in the less lucrative functions of teaching, instruction, extension work, testing, inspection and laboratory services, 6 per cent compared to 32 per cent for other science specialties as a whole, excluding agriculture and forestry. (See Table C–4).

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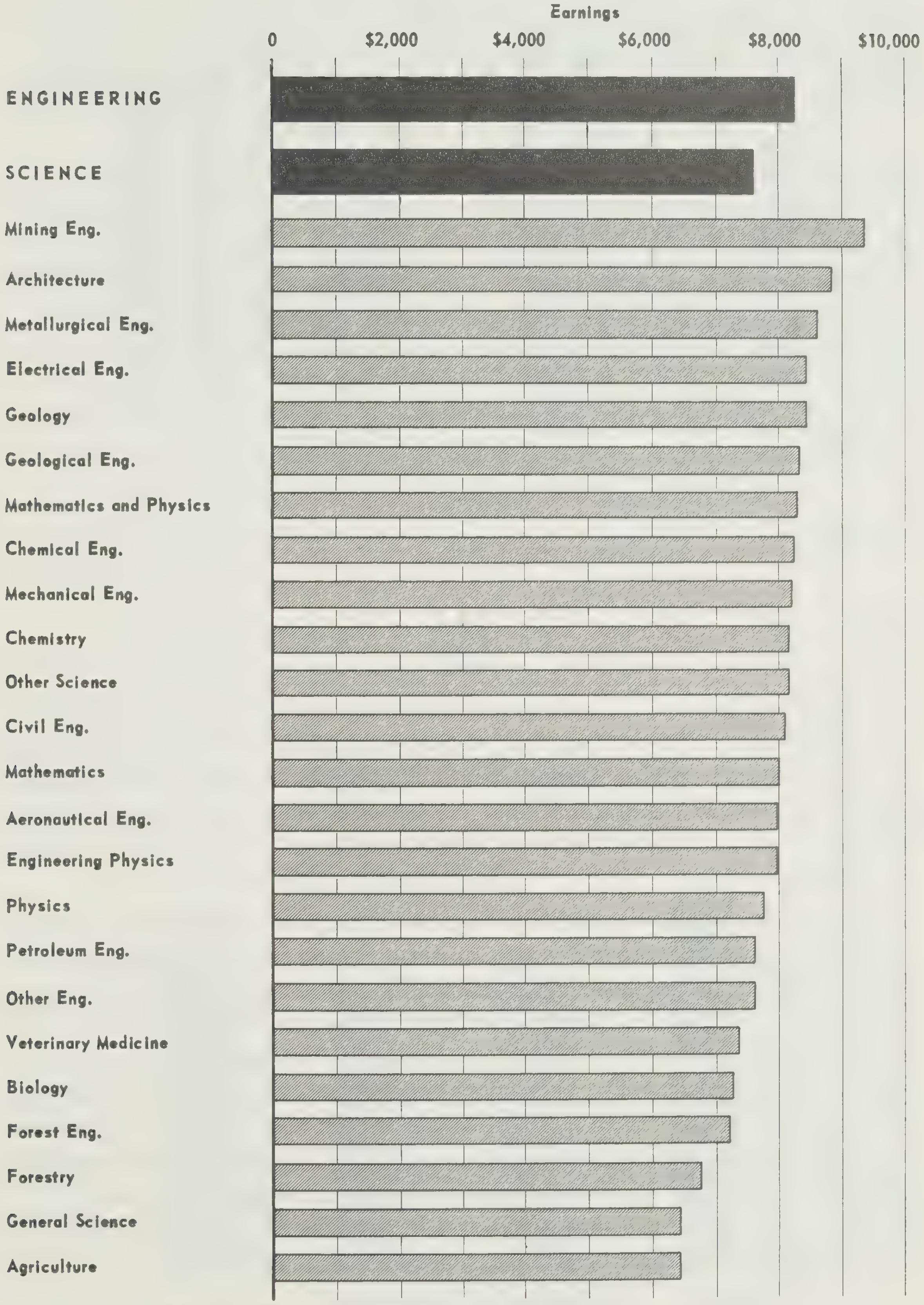
[1] The data in this section, based on Table A–6, are not comparable to those in Table 6, Professional Manpower Bulletin No. 7, for a number of reasons. First, the specialties here refer to academic course background rather than employment specialization as in Professional Manpower Bulletin No. 7. Second, as stated in the Introduction, earnings in the present bulletin are based on salary and non-salary type income taken together whereas in Professional Manpower Bulletin No. 7, earnings data were based on "salary type income" only. Table A–7 in this bulletin is closer to Table 6 in Professional Manpower Bulletin No. 7 since it is based on employment specialization. But it should be noted that the earnings in Table A–7 include both salary and non-salary type income.

[2] The earnings in architecture are different from those given in Table 6, Professional Manpower Bulletin No. 7 for the reasons mentioned in footnote[1]. Non-salary or fee income is of special importance to a group such as architecture, 55 per cent of whom are self-employed, compared to 6 and 8 per cent of scientists and engineers respectively, It is not surprising that substantial differences in earnings of architects are indicated in the present bulletin compared to the previous one.

Figure 5

HOW DO THE EARNINGS OF THOSE IN THE VARIOUS ENGINEERING AND SCIENTIFIC FIELDS COMPARE?

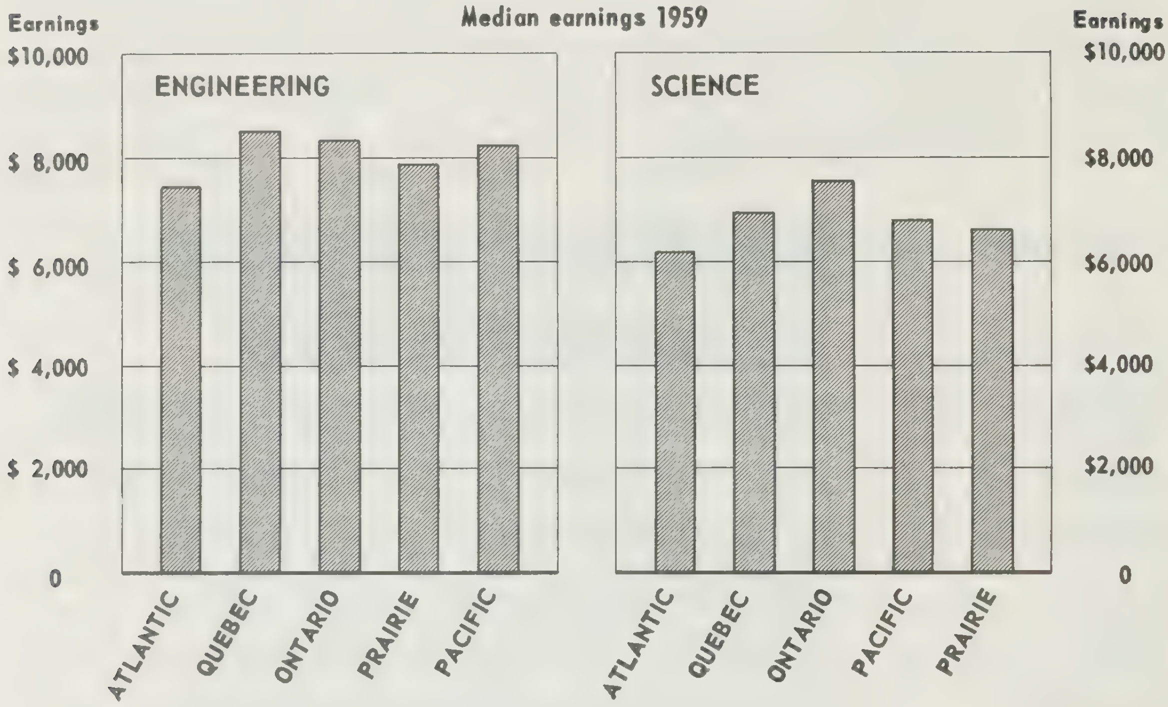


Source: Table A-6

96362—5

Figure 6

IN WHICH REGIONS OF CANADA ARE EARNINGS
IN ENGINEERING AND SCIENCE HIGHEST?



Source: Table A–8

In which regions of Canada are earnings of engineers and scientists highest?

Figure 6 and table A–8 reveal that engineers employed in Quebec earned most in 1959, with median earnings of $8,500. Engineers employed in the Atlantic region earned least – $7,450. This pattern holds for all experience levels except the most recent one, where engineers working in Quebec earned somewhat less than those in all other regions except the Atlantic.

The most persistent pattern in engineering as in science was that earnings of those employed in the Atlantic region were lowest by a significant margin. In engineering, total median earnings in 1959 of those in the Atlantic region at $7,450 were $450 below the earnings of the next lowest region, the Prairies, $7,900, and over $1,000 below earnings in the highest earnings region, Quebec, where earnings were $8,500. The earnings differential between those in the Atlantic region and those in the highest earnings region tended to increase with levels of experience. The earnings spread of engineers in the Atlantic and Quebec regions increased from $450 per year for those who graduated in the last ten years to $1,500 for those who received their bachelor's degrees 21–30 years ago

For science, total median earnings of $6,200 in the Atlantic region were $450 below earnings in the next lowest region, British Columbia – $6,650, and $1,350 below the median earnings of scientists in Ontario

who earned most — $7,550. The earnings spread between scientists in the Atlantic and Ontario regions widened from $750 for those who graduated over the last ten years to $1,550 for those who graduated 21—30 years ago.

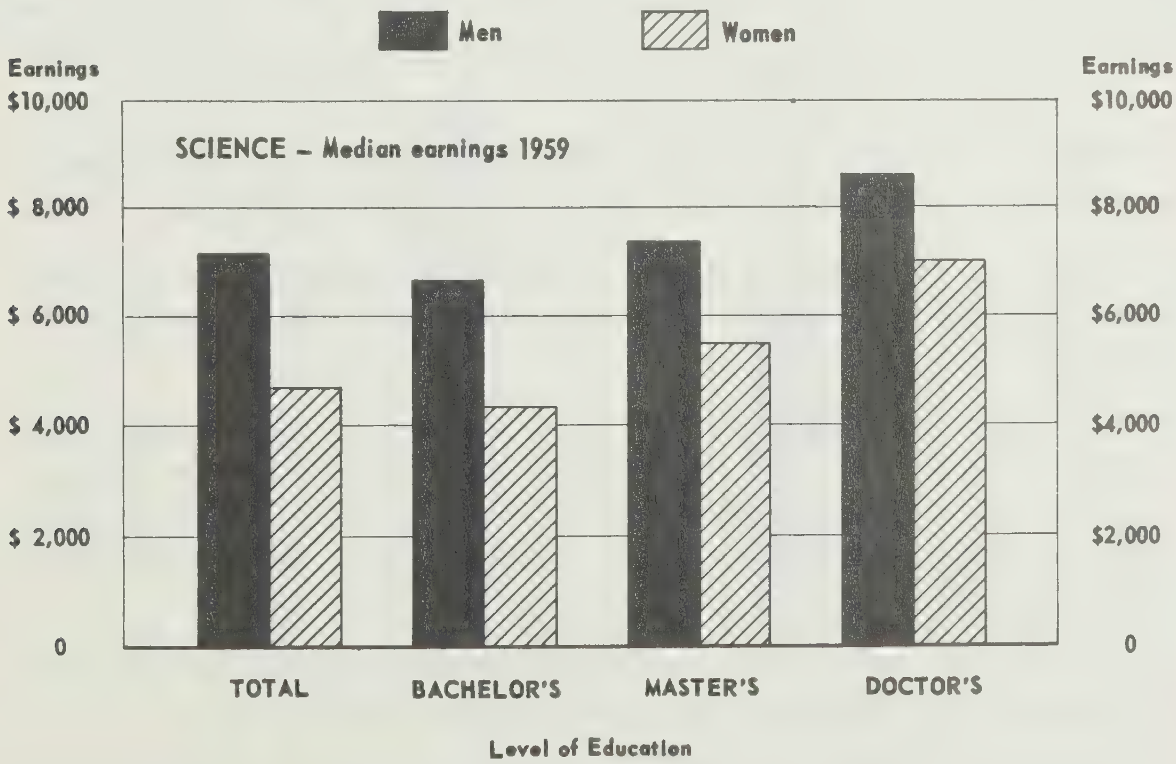
Are earnings of engineers and scientists born and educated in Canada as high as earnings of those who came from abroad?

Table A—9 provides a comparison of the earnings of those who were educated in Canadian universities and those who were educated abroad. In general for all experience levels as a group, the median earnings of engineers educated abroad — $8,900 — are $700 higher than the earnings of those educated in Canada.

The arrangement of the data for engineers in terms of experience revealed a different pattern, with those trained in Canadian universities enjoying highest earnings at all intermediate levels of experience. The earnings of the Canadian-trained were almost the same as those of the foreign-trained at the 1 to 10 year level of experience. For example, the Canadian-trained with 21—30 years of experience earned $10,800, or $1500 more than foreign-trained engineers whose median earnings were $9,300. Thus, the higher experience of the foreign-trained over 80 per cent of whom had more than 10 years experience compared to only 46 per cent of the Canadian trained with comparable experience accounts in large measure for their earnings advantage as a group over those trained in Canada.

Figure 7

HOW DO EARNINGS OF MEN AND WOMEN IN SCIENCE COMPARE?



Source: Table A—10

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On the other hand, a comparison of the earnings of the foreign-born educated at Canadian universities with more than 10 years experience shows little difference from the Canadian-born who were educated at home.

A comparison of the Canadian-born educated at home and Canadian-born educated abroad reveals that engineers with more than 20 years experience who were trained abroad enjoyed higher earnings generally than those who were educated here. In several cases since the numbers on which the earnings data are based are not large for those trained abroad, these differentials must be considered with this in mind.

For scientists in contrast to engineers, earnings differentials in favour of the foreign-trained persisted at all experience levels and were $850 per year for all levels of experience taken together.

How do earnings of men and women compare?

Male and female earnings comparisons for engineering have been omitted in Figure 7 and table A–10 owing to the small number of women in engineering.

The 1959 earnings of scientists at all experience and education levels were $7,150 for males and $4,700 for females giving an overall male-female earnings differential of $2,450 per year. Persistent narrowing of the differentials occurred in two directions: as education increased and as experience increased beyond the 20 year level. The overall male-female differential at the bachelor level was $2,350 but only $1,550 at the doctoral level. The differential was $2,100 for those who graduated within the last 10 years but only $100 for those who graduated 31–40 years ago.

The overall male-female earnings differential was increased by the fact that women in science are a somewhat younger group than men and experience and earnings are positively associated. Over 62 per cent of the women graduated within the last 10 years compared to only 46 per cent of the men.

Do those in scientific and technical professions who are self-employed have higher earnings than those who are working for an employer?

Table A–11 and Figure 8 make possible a comparison of the earnings of the self-employed with those who were working for an employer, by various industry groups.

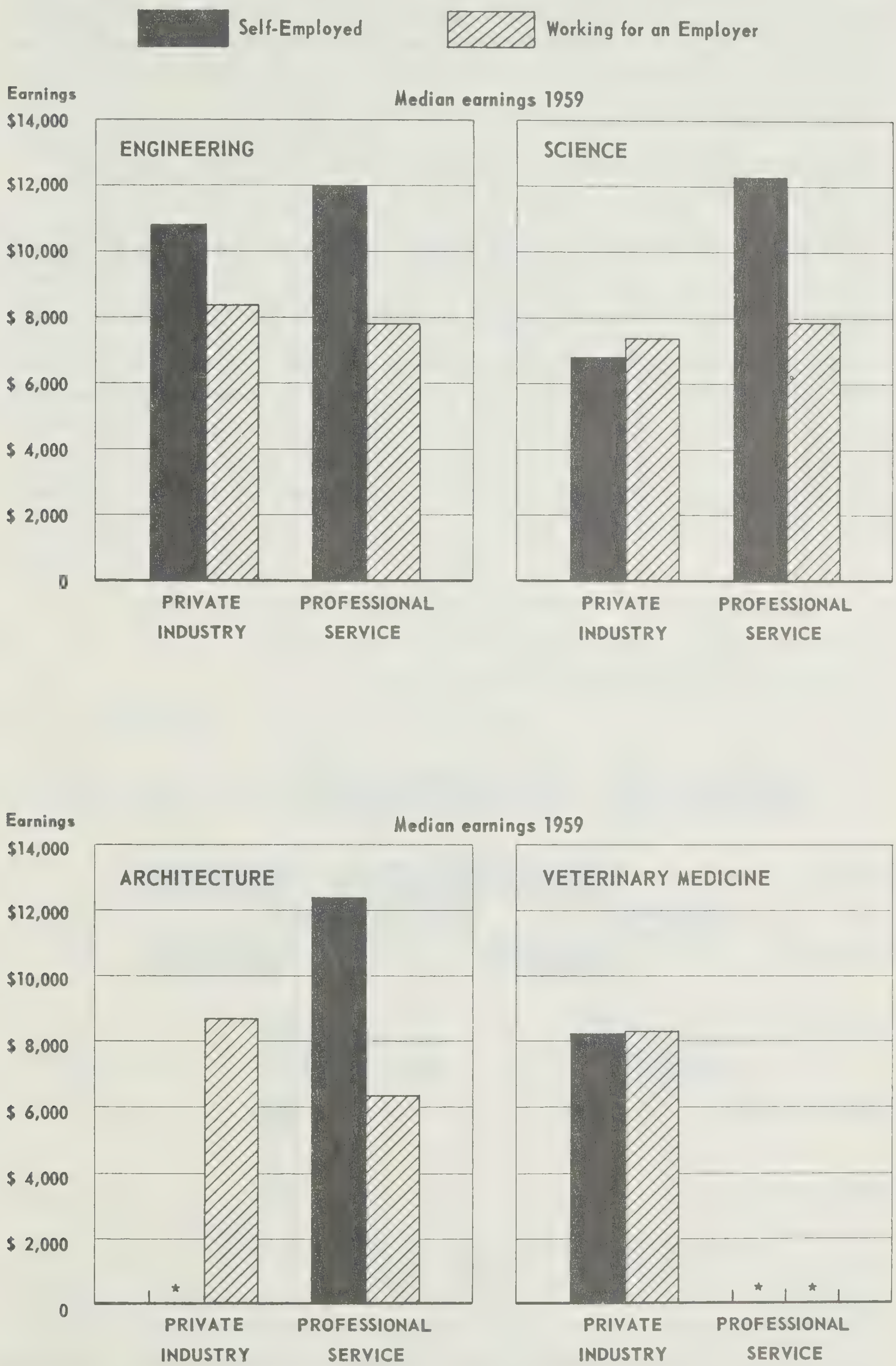
The broad conclusion is that those who are self-employed enjoy a considerably higher level of earnings than those who are not. In engineering for example, those who worked for an employer earned $8,150 in 1959 while the self-employed as a group earned $10,900, an earnings differential of $2,750.

In science, architecture, and veterinary medicine, the corresponding differentials were $750, $5,150, and $1,150 respectively.

In terms of industry group, however, scientists who were self-employed in private industry earned less than those who worked for an employer

Figure 8

HOW DO EARNINGS OF THE SELF-EMPLOYED COMPARE WITH EARNINGS OF THOSE WORKING FOR AN EMPLOYER?



Source: Table A–11

* *Medians for less than 10 cases not computed.*

in spite of the over-all differential in favour of the self-employed. Other data in the survey indicate that a large proportion of self-employed in private industry are recent graduates working in the primary industry sector, most likely agriculture, where earnings are considerably lower than the median earnings for all industries as a group. Earnings of veterinarians in the private sector were almost the same for the self-employed as for those who were working for an employer.

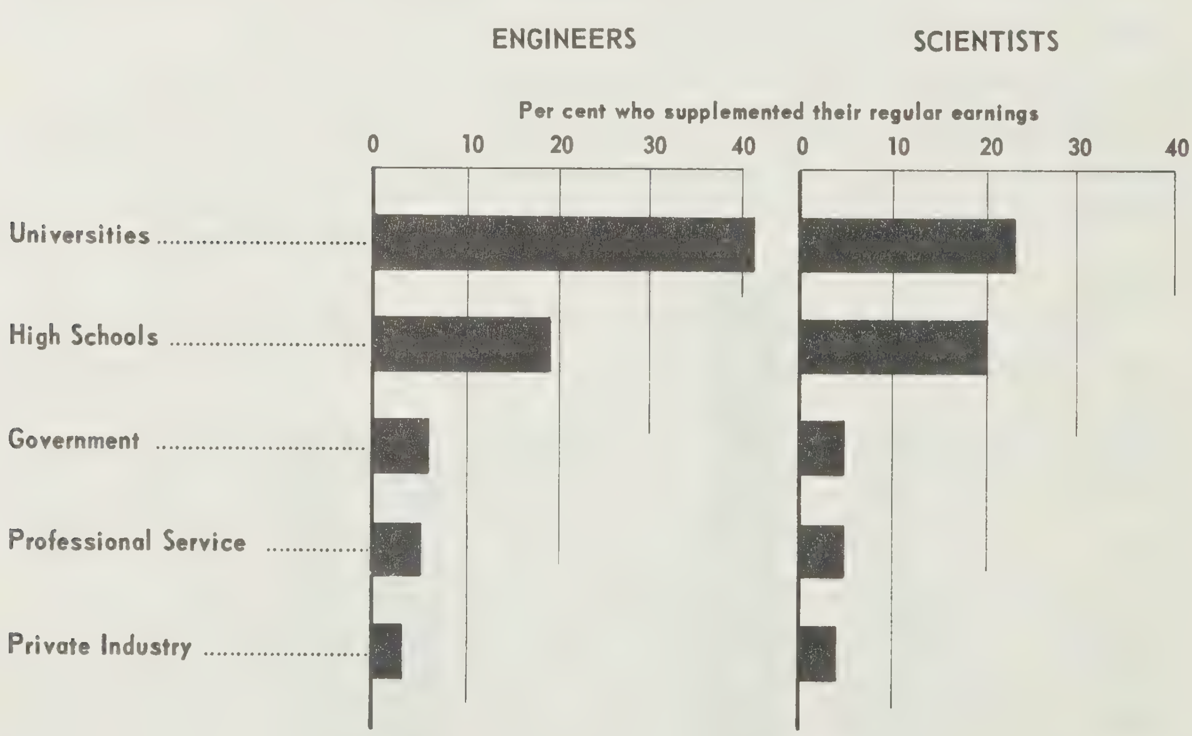
To what degree do the scientific and technical professionals employed by universities and other types of employers supplement their regular earnings? [1]

Scientific and technical personnel do not rely entirely on regular earnings for their total income. Almost 6 per cent supplement their earnings with other professional income as shown in Figure 9 and table A—12.

There were differences among the various types of scientific and technical professionals in the extent to which they supplemented their regular earnings. Only 4 per cent of all engineers supplemented their regular earnings, but 11 per cent of the architects reporting did so in 1959. Eight per cent of scientists and of those in veterinary medicine similarly added to their earnings.

Figure 9

TO WHAT DEGREE DO ENGINEERS AND SCIENTISTS EMPLOYED BY UNIVERSITIES AND OTHER TYPES OF EMPLOYER SUPPLEMENT THEIR REGULAR EARNINGS?



Source: Table A–12

[1] Figures given in this section are in no way comparable to those presented in the corresponding section of Professional Manpower Bulletin No. 7. The former report placed the earnings of the self-employed in the "other professional income" category, whereas the present report places the earnings of the self-employed in the "earnings only" category.

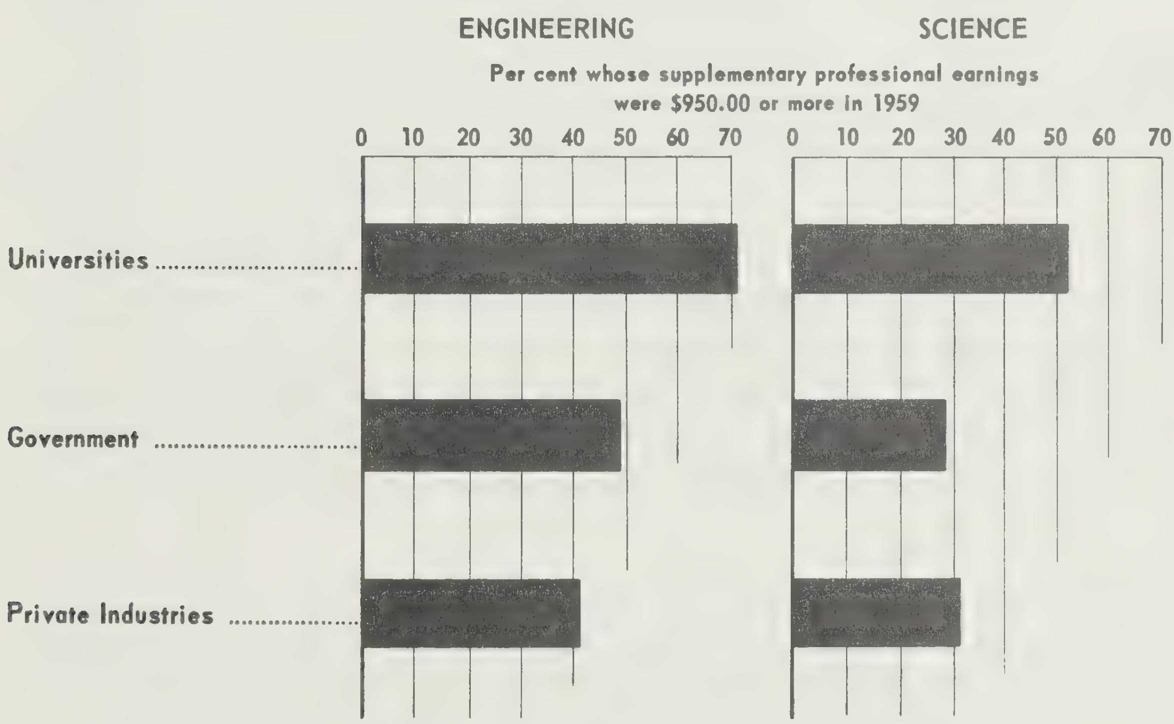
The likelihood of one supplementing one's income varied markedly as between those employed in different industries. As might be expected, those in educational institutions, universities and high schools, supplemented their earnings to a much greater degree than those employed elsewhere. Only 3 per cent of all scientific and technical professionals in private industry supplemented earnings with other professional income, but 28 per cent of all those in universities and 20 per cent of all those in high schools did so. The percentage of those supplementing their earnings with other professional income was about 6 per cent for government and for professional service.

In contrast to the general pattern which showed a higher proportion of scientists with supplementary professional earnings, 40 per cent of the engineers in universities compared to only 23 per cent of scientists in universities added to their regular earnings.

From Table A–13 it is apparent that educational level exerts some influence in determining the degree to which regular earnings are supplemented with other professional earnings. The higher the educational level, the greater the extent to which people tended to supplement their regular earnings.

Figure 10

HOW MUCH SUPPLEMENTARY EARNINGS DO THOSE IN ENGINEERING AND SCIENCE WHO ADD TO THEIR REGULAR EARNINGS ACTUALLY RECEIVE?



Source: Table A–14

In the case of both engineers and scientists, approximately 4 per cent of those at the bachelor level compared to around 9 per cent at the master's and 13 per cent at the doctor's level received additional professional income. For those in universities, this tendency was less evident especially as between the master's and doctoral level.

In Table A–14 and Figure 10, some indication is given of the amount of supplementary income that was earned by engineers and scientists who

worked for various types of employers. Of those engineers who did supplement their incomes, almost one-half earned $950 or over per year in addition to regular earnings. About one-third of all scientists who supplemented their regular earnings earned $950 or over.

But about 7 out of every 10 engineers in universities who earned extra income earned $950 or over. In the case of scientists employed by universities 5 out of every 10 supplemented their regular earnings.

It is apparent that an account of the earnings of scientists and engineers in universities must take into consideration both the substantial number who supplement their earnings and the amount of those supplementary earnings. Almost one out of every four scientists and two out of every five engineers supplement their earnings. About 50 per cent of the scientists who supplemented their earnings earned over $950 per year but 70 per cent of the engineers who added to their regular earnings received over $950 per year in supplementary earnings.

Chapter 2 – EMPLOYMENT

Employment data on scientific and technical professionals are given in Tables 3 to 5, and Tables B–1 to B–8.

Who employs scientific and technical personnel, especially the recent graduates?[1]

The data for this section are given in Tables 3,4 and 5. As in earlier surveys made by the Department of Labour, the results of the 1959 survey indicated that there were wide differences among the major industrial groups in the employment of engineering and scientific personnel. Some 80 per cent of the engineers were in private industry (including professional service) while only 47 per cent of the scientists were similarly employed.

The manufacturing industries taken together employed 37 per cent of the engineers but only 22 per cent of the scientists. The proportion of engineers employed in manufacturing industries was higher than that of scientists, and was concentrated to a much greater degree in those industries producing durable goods.[2] Twenty-one per cent of all engineers were in the durable goods manufacturing sectors, compared to 5 per cent of those who were trained in science. In the remaining manufacturing industries, mainly non-durables, the proportions of engineers and scientists were about even, 16 and 17 per cent respectively.

The proportion of engineers in construction, transportation, storage and communication, and public utilities was also much greater than the proportion of scientists, 18 per cent compared to 4 per cent. The same was true of professional service.

But scientists were more heavily represented in governments than were engineers, the respective proportions being 33 per cent and 17 per cent. Scientists were more heavily represented with the federal government – 20 per cent as opposed to 9 per cent of the engineers being so employed. However, the proportion of engineers employed by local governments was higher than scientists – 3 per cent compared to 1 per cent.

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1 Differences between figures given here and those provided in Professional Manpower Bulletin No. 7 do not necessarily reflect changes in the actual employment distribution of scientific personnel. Coverage of high school teachers was substantially increased which probably accounts for their apparent increase from 3 per cent to 11 per cent of the scientific personnel surveyed. Because of this the percentages of scientists employed in other industry groups are lower, as are percentages which represent combinations of scientists and engineers. While coverage of engineers employed in high schools was similarly increased, their number is so small as to have virtually no effect on the data. In addition, it should be noted that in this bulletin, the Armed Forces are included in the "Federal Government" category. But the basic survey data identify armed forces personnel as such should information on them be required. See Appendix 2 for additional information on industry groupings.

2 Includes: wood products; iron and steel products; transportation equipment; non-ferrous metal products; electrical apparatus; non-metallic mineral products.

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Table 3 – Employment in Engineering and Science by Selected Industries, 1959

Industry	Engineering		Science	
	Number	%	Number	%
Primary (except mining)	38	1	215	4
Mining	528	6	210	4
Manufacturing				
Foods, Beverages and Tobacco	77	1	215	4
Rubber, Leather and Textiles	119	1	45	1
Wood Products	51	1	48	1
Paper Products	320	4	130	3
Iron and Steel Products	628	7	58	1
Transportation Equipment	225	3	29	1
Non-Ferrous Metal Products	182	2	36	1
Electrical Apparatus	597	7	52	1
Non-Metallic Mineral Products	111	1	21	*
Petroleum and Coal Products	257	3	79	2
Chemical Products	489	6	355	7
All Others	68	1	18	*
Total, Manufacturing	3,124	37	1,086	22
Construction	623	7	30	1
Transportation, Storage and Communication	454	5	76	2
Public Utilities	530	6	32	1
Trade, Finance, Insurance, Real Estate	617	7	329	7
Professional Service	907	11	204	4
Universities	191	2	457	9
Governments				
Federal Government	737	9	992	20
Local Governments	282	3	32	1
Provincial Governments	377	5	562	12
Total, All Governments	1,396	17	1,586	33
High Schools	66	1	529	11
Other Industries	16	*	89	2
Total, All Industries	8,490	100	4,843	100

Source: Survey of Scientific and Technical Personnel, 1959.
* Less than ½ of one per cent.

A larger percentage of scientists than engineers were employed with provincial governments, universities and high schools.

Table 4 makes possible a comparison of the experience levels of engineers in various industries. Just over one-half of all engineers had less than 11 years' experience, but the proportion of engineers in this youngest group varied considerably from industry to industry. Engineers employed by governments tended to be somewhat younger than those employed by private industry as a whole. For example, 58 per cent of the engineers employed by governments had less than 11 years of experience compared to 52 per cent of those in manufacturing. In the case of major industry groups employing engineers, the federal government and industries manufacturing petroleum and coal products had the largest proportion of engineers in the youngest experience category, 61 and 62 per cent respectively. At the opposite extreme, manufacturers of non-metallic mineral products, universities, and mining industries tended to have smaller proportions of young engineers – 40, 44 and 46 per cent respectively with under 11 years of experience.

Table 5 compares the level of experience of scientists in various industries. The same proportion of scientists as engineers, about one-half, had less than 11 years of experience. The percentage of young scientists employed by governments as a whole and by manufacturing industries was close to the general average for all industries, about one-half having less than 11 years of experience. But wide differences in the experience levels of scientists were exhibited by some major employers of scientists. Universities had the smallest proportion of young scientists – 33 per cent. The mining and the petroleum and coal products manufacturing industries had the largest proportion of young scientists, 61 and 60 per cent respectively.

How do field of employment specialization and type of job performed vary from one industry to another?

Tables B–1 and B–2 show the relationship between industry and field of employment specialization for scientists and engineers.[1] Table B–1 shows that of the engineers who remained in engineering fields of employment specialization, the largest single group, 37 per cent, went to the manufacturing sector although there was considerable variation among fields of employment specialization as shown in Table B–1. For instance, 76 per cent of those in chemical engineering, and 62 per cent of those in

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[1] The basic breakdown here was in terms of academic course, so architecture and veterinary medicine are excluded since the basic course groups are engineering and science. Only those engineering and science graduates who shifted into the architecture and veterinary medicine fields of employment specialization appear under the latter headings. This accounts for the small totals which appear under the employment specialties of architecture and veterinary medicine in Tables B–1 and B–2. In Table B–1 it may also be noticed that about 10 per cent of the science graduates appear in engineering fields of employment specialization, and in Table B–2 that about 13 per cent of the engineering graduates moved out of engineering into other fields of employment specialization.

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Table 4 – Employment Distribution of Engineers by Selected Industries and Years from Bachelor Graduation, 1959

Industry	Total		Years from Bachelor Graduation									
			Over 40		31–40		21–30		11–20		1–10	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Private Industry, Total[1]	6,837	100	120	2	525	8	1,000	15	1,743	25	3,449	50
Mining	528	100	3	*	47	9	109	21	127	24	242	46
Manufacturing, Total	3,124	100	35	1	220	7	464	15	794	25	1,611	52
Non-Metallic Mineral Products	111	100	2	2	11	10	25	22	29	26	44	40
Petroleum and Coal Products	257	100	–	–	6	2	29	11	64	25	158	62
Universities	191	100	3	2	20	10	33	17	51	27	84	44
Governments:												
Federal Government	737	100	3	–	36	5	105	14	146	20	447	61
Provincial Governments	377	100	13	4	27	7	62	16	58	15	217	58
Local Governments	282	100	6	2	23	8	40	14	67	24	146	52
All Governments, Total	1,396	100	22	2	86	6	207	15	271	19	810	58
High Schools	66	100	–	–	16	24	12	18	10	15	28	43
Total, All Industries	8,490	100	145	2	647	8	1,252	15	2,075	24	4,371	51

Source: Survey of Scientific and Technical Personnel, 1959.

* Less than ½ of one per cent.

1 Includes professional (business) service. See Appendix 2 for explanation of "industry" groups.

Table 5 – Employment Distribution of Scientists by Selected Industries and Years from Bachelor Graduation, 1959

Industry	Total		Years from Bachelor Graduation									
			Over 40		31–40		21–30		11–20		1–10	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Private Industry, Total[1]	2,271	100	18	1	118	5	318	14	633	28	1,184	52
Mining	210	100	1	–	8	4	33	16	39	19	129	61
Manufacturing, Total	1,086	100	6	–	54	5	171	16	313	29	542	50
Petroleum and Coal Products	79	100	–	–	1	1	9	11	22	28	47	60
Universities	457	100	8	2	63	14	94	20	142	31	150	33
Governments												
Federal Government	992	100	4	–	78	8	191	19	266	27	453	46
Provincial Governments	562	100	11	2	47	9	90	16	114	20	300	53
All Governments, Total	1,586	100	15	1	127	8	283	18	389	24	772	49
High Schools	529	100	3	1	47	9	113	21	115	22	251	47
Total, All Industries	4,843	100	44	1	355	7	808	17	1,279	26	2,357	49

Source: Survey of Scientific and Technical Personnel, 1959.

[1] Includes professional (business) service. See Appendix 2 for explanation of industry groups.

mechanical engineering, compared to only 8 per cent of those whose field of employment specialization was civil or mining engineering, were employed in manufacturing. Engineers in the different fields of employment specialization were predominantly employed in the particular manufacturing industries which one would anticipate. For example, 42 per cent of all engineers specializing in aeronautical engineering were employed in the transportation equipment industry. Twenty per cent of those in metallurgical engineering were in non-ferrous metal products and 21 per cent in the iron and steel industry.

Although the three levels of government together employed 17 per cent of the practising engineers, there was a divergence between fields of employment specialization. Governments employed 38 per cent of all those engaged in aeronautical engineering, and the same proportion of civil engineers but only 4 per cent of those in chemical engineering and petroleum engineering.

Professional service employed 11 per cent of all practising engineers, but 19 per cent of all civil engineers reporting in the survey were in this sector. Furthermore, civil engineers represented 52 per cent of all the practising engineers engaged in the provision of professional service to business.

Table B–2 shows that almost one-quarter of the science graduates in the science category of fields of employment specialization were employed in manufacturing industries, but they were most unevenly distributed by fields of employment specialization. Those working in chemistry alone accounted for half of all the science graduates in manufacturing. All other scientific fields of employment specialization were very lightly represented in manufacturing.

Differences existed among the fields of employment in science in the extent to which they favoured certain industries. Over one-half of the chemists were in the manufacturing sector, compared to 2 per cent and 5 per cent of those in mathematics or physics. The pattern was reversed in the university sector, with 9 per cent of the chemists and 25 and 20 per cent respectively of mathematics or physics graduates employed there.

Of the science graduates working for the government, 696 out of 1,483, nearly half, were working in agricultural fields of employment specialization. The federal and provincial governments together employed 60 per cent of all scientists whose fields of employment specialization were in agriculture. The federal government alone employed 49 per cent of all scientists working in physics.

The largest single group of science graduates employed by universities were working in biology, 99 out of 439 or 23 per cent, and the second largest group were in agriculture, these fields of employment specialization together accounting for 43 per cent of those with scientific undergraduate training employed by universities

The type of job performed as well as the field of employment special. ization varied from industry to industry as Tables B–3 and B–4 show.

Scientists tended to concentrate in research and development, 23 per cent; teaching, instruction and extension work, 21 per cent; and executive and administrative functions, 18 per cent. Engineers were concentrated in functions of executive and administrative, 29 per cent; design, 15 per cent; production operation and maintenance, 15 per cent. The detailed industrial breakdowns of scientists and engineers by functions and type of employer are shown in Tables B–5 and B–6.

Tables B–3 and B–4 indicate that although scientists are a numerically smaller group than engineers, they outnumbered them in the functions of field exploration, research and development, teaching, instruction and extension work, and testing, inspection and laboratory services in ratios of approximately 4 to 3, 2 to 1, 4 to 1, and 3 to 2 in that order. There were also more scientists than engineers employed by primary industries, universities, the federal government and high schools, the ratios being 6 to 1, 5 to 1, 4 to 3, and 8 to 1 respectively. More engineers than scientists were, of course, employed in manufacturing industries, but in foods, beverages and tobacco production scientists out numbered engineers in the ratio if nearly 3 to 1. Although there were more scientists than engineers in the federal government, there were more engineers in executive and administrative positions in the federal government than there were scientists. Furthermore, although there were more scientists than engineers in research and development positions in the country as a whole there were slightly more engineers than scientists in research and development positions in the manufacturing sector of the economy. This reflects the greater tendency for engineers to enter the manufacturing industry.

Considering engineers alone, Table B–3 shows that in the manufacturing industry, as a whole a considerably higher percentage, 23 per cent, performed the functions of production, operation and maintenance than in all industries together, 15 per cent. In the manufacturing sector, the proportion in design was about the same for all types of industries. The proportion in manufacturing engaged in sales, service, marketing and purchasing was slightly higher at 14 per cent compared to the average for all industries of 10 per cent. Amongst the manufacturing industries there was considerable variation. The industries with the largest proportions of their engineers involved in designing work were transportation equipment, electrical apparatus, and iron and steel with 26, 24 and 20 per cent respectively. Two of these three industries which had unusually high percentage of their engineers occupied in sales, service, marketing and purchasing – the electrical apparatus industry with 23 per cent and the iron and steel industry with 21 per cent.

Slightly over one-half – 52 per cent of the engineers in trade, finance, insurance, and real estate – were engaged in sales, service, marketing and purchasing and another 25 per cent were in executive and administrative positions.

Of the engineers in professional service, one-third recorded their function as designing and nearly one-quarter stated they were in executive and administrative posts.

While the largest group of engineers in the federal government, 34 per cent, were in executive and administrative work, the proportion engaged in research and development, 22 per cent, was the highest for any type of employer. Provincial and local governments had high percentages, 23 per cent and 22 per cent respectively, of their engineers occupied with construction, installation and erection.

The figures in Table B—4 show the functions performed by scientists working in different industrial sectors.

Scientists employed in manufacturing industries tended to enter executive and administrative and research and development positions — 23 per cent of the total were engaged in each. They differed from the average for all scientists by having a greater percentage in production, operation and maintenance, sales, service, marketing and purchasing, and testing, inspection and laboratory work — 18 per cent, 13 per cent, and 13 per cent respectively — than did scientists as a whole.

Every fifth scientist employed in Canada worked for the federal government and over one-half, 53 per cent, of the scientists so employed were in research and development positions. In fact, the federal government directly employed nearly one-half of the Canadian scientists engaged in research and development.

The major functions performed by scientists in provincial governments were teaching, instruction and extension work — 31 per cent — and executive and administrative — 23 per cent.[1]

What work functions are performed by men, younger graduates and those who have post-graduate degrees in scientific and technical fields?

Tables B—5 and B—6 deal with the relations among jobs, experience and level of education of engineers and scientists. Scientists comprised only 36 per cent of the total number of engineers and scientists, but they comprised 80 per cent of the scientists and engineers in teaching positions, 59 per cent of all scientists and engineers in testing, inspection and laboratory services, and 65 per cent of those in research and development positions. On the other hand, they were under-represented relative to engineers in administrative and executive positions, possibly because relatively few of them were in private industry as shown in Tables B—1 and B—2.

Table B—5 shows that the functions performed by engineers varied with experience levels. Nearly half of the engineers with 30 or more years of experience were in executive or administrative posts in 1959, but only 16 per cent of those with less than 11 years of experience were in such

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[1] A small but undetermined number of high school science teachers appear to have reported themselves as employees of local governments rather than of school boards. For this reason, the figures for scientists employed by local governments and by high schools may not be completely accurate. This, of course, will not affect the reliability of the figures for other employers.

positions. The opposite tendency can be seen in such functions as production, operation and maintenance, research and development and design where the percentage so engaged declined with increasing years of experience.

In Table B–6 it is found that scientists displayed basically the same pattern as engineers in regard to experience and function performed. Nearly one-third of the scientists with 30 or more years of experience were in executive or administrative work while only slightly more than one-tenth of the more recent graduates were thus employed. The trend was similar but weaker in regard to teaching, instruction and extension work, where 29 per cent of those with 30 or more years of experience were so occupied as compared with 19 per cent of the more recent graduates. Trends in the opposite direction are observable in respect to testing, inspection and laboratory work, research and development, sales, service, marketing and purchasing in particular. The percentage engaged in testing, inspection and laboratory services for example, rose from 3 per cent for those with more than 30 years of experience to 9 per cent for those who graduated less than 11 years before the date of the survey.

The data also permit a few generalizations in regard to the relationship between function and level of education for both scientists and engineers, although the number of engineers with post-graduate degrees is rather small in some of the classifications. In general, the more education a scientists or engineer received, the less likely he was to be engaged in executive and administrative work, production, operation and maintenance or sales, service, marketing and purchasing. On the other hand, he was more likely to be occupied with either research and development or teaching, instruction and extension work. These associations between level of education and function performed hold true at most but not all levels of experience. For instance, considering the scientists who graduated from 11 to 30 years before the survey was made, 19 per cent of those with bachelor's degrees, 22 per cent of those with master's degrees and 30 per cent of those with doctor's degrees were engaged in teaching, instruction and extension work. But the association between level of education and work function performed was not evident in the case of scientists engaged in teaching who graduated less than 11 years before the survey date. Nineteen per cent in this group who held only bachelor's degrees were in teaching jobs, as were 19 per cent of those with master's degrees, and 22 per cent of those with doctor's degrees.

In Table B–7, a comparison is drawn between the proportion of men and women who performed certain types of jobs. Since the "engineering" and "science" specialties used here are based on employment, this table is comparable to Table 11 in Professional Manpower Bulletin No. 7.

Only a fraction of one per cent of those in engineering were women. In science, 183 out of 4,443 or about 4 per cent were women. The vast majority, 84 per cent, of women scientists were concentrated in testing, inspection and laboratory services, teaching, instruction, extension work, and research and development. Even in testing, inspection

and laboratory services where they were most heavily concentrated, they accounted for only 15 per cent of the scientists involved.

In which scientific and technical fields are the greatest proportion of women found?

Only a very small percentage of scientists and engineers were women, as shown by Table B–8. The 2 per cent of the total who were women are unevenly distributed between fields of employment specialization. While the percentage of women in engineering fields was negligible, they made up 6 per cent of the total of scientists, excluding those in agriculture and forestry. Within the fields of science they were again unevenly distributed, being most heavily represented in the fields of biology and mathematics, where they comprised 22 per cent and 9 per cent of the total respectively.

Chapter 3 – RELATION BETWEEN EMPLOYMENT AND EDUCATION

Information on the relation between the employment and educational background of scientific and technical professionals is included in Tables 6 to 9 and Tables C–1 to C–4.

Table 6 – Undergraduate Course by Field of Employment Specialization, Scientific and Technical Professionals, 1959

Undergraduate Course	Those who Took Undergraduate Course		Those who Worked in a Field of Employment Similar to Undergraduate Course	
	No.	Per cent	No.	Per cent
Life Sciences (Agriculture, Biology, Forestry, Veterinary Medicine)	2,664	100	2,035	76
Geology	280	100	220	79
Physics or Mathematics and Physics	440	100	185	42
Chemistry and Chemical Engineering	1,874	100	1,174	63
Mathematics	115	100	67	58
Engineering (excluding Chemical Eng.)	7,537	100	6,111	81
Geography	–	–	–	–
Architecture	381	100	362	95
Other	1,058	100	260	25
Non-Engineering, Non-Scientific	18	100	2	11
Total – All Courses	14,367	100	10,178	71

Source: Table C–1

Are graduates with only bachelor's degrees employed in fields that are closely related to their academic courses of study?

The course-field picture is one aspect of the career patterns followed by scientific and technical professionals working in Canada. A substantial proportion of the scientific and technical professionals did not proceed into a field of employment specialization directly related to their academic training after bachelor graduation.

Table C–1 shows that 8,065 out of 14,367 or 56 per cent of the scientific and technical persons worked in fields of employment special-

96362–7½

ization which corresponded to their undergraduate courses.[1] Conversely, 44 per cent worked in fields which did not directly correspond to their academic course.

But in Table 6, the course-field shifts are given in the context of a broader grouping of similar academic courses and employment fields than in Table C–1. The proportion who moved outside these broad groups was only 29 per cent. About 20 per cent of the engineering graduates were employed in fields of employment specialization outside engineering fields. This narrowing of course-field movement probably presents a more accurate picture of the extent of such movement. Courses such as mathematics and physics and chemistry, which showed a large outward movement, provide a general training which is utilized in many other areas of activity.

The course-field movement was analyzed in more detail from two standpoints: first, movement from course to employment fields; secondly, movement to fields of employment specialization from various courses.

From the first viewpoint, the relevant question was: What fields of employment specialization did those in various courses enter? Within engineering, the two extremes are chemical and petroleum engineering. Of those who graduated in chemical engineering, 298 out of 1,142 or 26 per cent, were shown as having become employed in chemical engineering. Three hundred and forty-eight out of 1,142 or 30 per cent, were employed in the field of chemistry. The significance of this is not entirely clear, first because the two fields are so similar that they should perhaps be considered together. Secondly, in the survey classification list of fields of employment specialization, a wider choice of sub-specialties was given under chemistry than under chemical engineering and so a good many chemical engineers may have classified themselves in the field of chemistry since they did not find an appropriate sub-specialty in the chemical engineering list.

In the case of petroleum engineering a high proportion, 47 out of 50 or 94 per cent who graduated in petroleum engineering became employed in the petroleum engineering field. The same was true for architecture and veterinary medicine, with only 5 per cent becoming employed in fields different from their undergraduate course specialties. In the case of graduates in biology, although over 2 out of 5 were employed in fields shown as different from the undergraduate course taken, over half of these latter or 1 out of 5 were employed in agriculture, a field closely related to the life science, biology.

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[1] Professional Manpower Bulletin No. 7 showed a higher proportion – 70 per cent – so employed. The difference in the present report is due mainly to the change in coding and tabulating, which resulted in the inclusion of about 1,750 persons, the "non-practicing", who indicated that they were not working in scientific and technical fields of employment specialization.

Other courses such as general science and engineering physics did not have fields of employment listed which directly corresponded to courses of undergraduate study, and graduates from these courses went into a variety of fields of employment specialization. Over 1 out of 4 general science graduates, a higher proportion than in any other specialty, were not in the scientific or technical fields at all. For agricultural graduates, the proportion not in scientific or technical fields was almost 1 out of 5.

The other way of approaching the course-field data was to ask the question: What academic courses did those in the various fields of employment specialization take? In several cases, it was apparent that although certain courses may not have contributed a large proportion of their graduates to "outside" employment fields, these employment fields had nevertheless drawn a substantial proportion of their personnel from these particular academic courses.

In the case of the petroleum engineering course, for example, about 1 out of 20 petroleum engineering graduates were employed outside the petroleum engineering field. But in the employment specialty of petroleum engineering, 9 out of 10 were trained in academic courses other than petroleum engineering. About 1 out of 20 graduates in architecture worked outside the field of architecture, but over 1 out of 4 employed in architecture were trained in academic courses other than architecture, mainly in engineering courses.

In the case of engineering courses as a whole, for example, (excluding chemical engineering) the reverse pattern was true. Although 1 out of 5 engineering graduates worked in employment fields outside engineering, yet only 1 out of 10 persons employed in engineering fields as a whole took academic courses outside engineering.

A further question was whether the course-field movement was in any way associated with earnings, as shown in A–6. A preliminary examination suggested that there was no clear-cut relation, for example, between movement into a field of employment specialization with high earnings and movement from an academic course specialty where earnings were typically low. And even if such an association were discovered, the conclusion would still be in doubt. Many reasons besides earnings could account for such movement, such as similarity of training requirements of particular courses and fields; demand for new entrants in particular fields and industries associated with those fields; attractiveness of particular fields, etc. It would be necessary to standarize such factors and hold them constant before an association could be established between course-field movement and earnings.

Are scientific and technical professionals employed in the geographical region where they were educated?

The information in Tables 7 and C–2 provides an indication of regional movement of engineers and scientists who were educated and em-

Table 7 – Inter-Regional Movement of Engineers and Scientists Employed in Canada in Terms of Region of Undergraduate Education and Place of Employment, 1959

Region	Place of Undergraduate Education A	Place of Employment B	Place of Undergraduate Education and Employment Identical C	Gross Loss A–C	Outward Movement $\frac{(A-C)}{A}$	Gross Gain B–C	Inward Movement $\frac{(B-C)}{B}$	Net Loss or Gain (∓) $[(B-C)-(A-C)]$	Net Loss or Gain (− or +) as a Per Cent of Employment $\frac{[(B-C)-(A-C)]}{B}$
	No.	No.	No.	No.	%	No.	%	No.	%
Engineering									
Atlantic	645	380	294	351	54	86	23	−265	−70
Quebec	1,626	2,044	1,231	395	24	813	40	+418	+20
Ontario	3,227	3,689	2,565	662	20	1,124	30	+462	+13
Prairie	1,619	1,087	822	797	49	265	24	−532	−49
Pacific	746	663	427	319	43	236	36	− 83	−13
Total, Engineering	7,863	7,863	5,339	2,524	32	2,524	32	–	–
Science									
Atlantic	476	315	181	295	62	134	42	−161	−51
Quebec	933	884	616	317	34	268	30	− 49	− 6
Ontario	1,594	1,935	1,319	275	17	616	32	+341	+18
Prairie	1,078	975	774	304	28	201	21	−103	−11
Pacific	526	498	385	141	27	113	23	− 28	− 6
Total, Science	4,607	4,607	3,275	1,332	29	1,332	29	–	–
Total, Engineering and Science	12,470	12,470	8,614	3,856	31	3,856	31	–	–

Source: Table C–2.

ployed in Canada, as well as some idea of the regional variation in the ratio of engineers to scientists. The data may be examined from two viewpoints: to determine where in Canada the graduates went for employment after graduation and to determine where those employed in the various regions received their undergraduate education. The analysis will deal only with those who were educated and employed in Canada.[1]

The data are arranged in order to illustrate insofar as the data allow, the comparative "losses" and "gains" of the various regions in terms of the proportion of engineers and scientists educated in particular regions who were no longer employed there. The outward and inward pattern of "movement" among regions is also indicated by the the data, within the limitations noted in the previous footnote. "Gross loss", (A–C) was calculated by subtracting the number who were still employed in the region where they were educated from the total number educated there. "Gross gain", (B–C) was calculated by subtracting the number who were still employed in the region where they were educated from the total number employed there. "Outward movement", (A–C)/A was calculated by taking the number of those who were employed outside the region where they were educated as a proportion of those who were educated there. "Inward movement", (B–C)/B was calculated by taking the number of those who were educated outside the region where they were employed as a proportion of those employed there. Finally, $[(B-C) - (A-C)]/B$ represents the net number lost or gained as a proportion of total engineers and scientists employed in the various regions.

About 1 out of 3 engineers and scientists were employed outside the province where they were educated. Engineers who received undergraduate degrees in Ontario or Quebec were less prone than those educated in other regions to be employed elsewhere. The difference in this respect was greatest between the Ontario and the Atlantic regions. Two out of 10 engineers who received their undergraduate education in Ontario were employed in other regions of Canada, but a substantial majority of the engineers reporting as graduating from Atlantic universities, more than 5 out of every 10, obtained employment elsewhere in Canada.

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1 These data are very crude mobility indicators for a number of reasons. In the first place these data are not related to any definite time period. Secondly, the mobility of native-born in a region cannot be inferred from the data since "moving" in this case is defined as graduates in one province who became employed in another. This does not indicate geographic mobility in the usual sense since the "movers" may have maintained permanent residence in one province e.g., Ontario, and gone to another area to study e.g., Quebec. In addition, the figures probably understate the percentage of the graduates from any one region who leave that region to work. This occurs because the survey covers primarily engineers and scientists working in Canada. An undetermined number of Canadian-educated engineers and scientists have permanently left Canada to work elsewhere and so do not appear in the survey. The figures given elsewhere in this report of "Canadians not working in Canada" do not adequately represent the size of this group. The figures representing foreign-educated scientists and engineers working in Canada are, of course, more representative.

For scientists, the Ontario-Atlantic contrast was even greater, the corresponding ratios being about 2 out of 10 in the case of Ontario, and 6 out of 10 in the case of the Atlantic region, who were employed outside the area where they received their undergraduate education.

Within the limitations noted in footnote [1] on the previous page, the data provide some idea of the degree of inward mobility. A majority of engineers and scientists working in a particular region, an average of 7 out of 10, received their bachelor education in that region. For engineers, the Quebec and Pacific regions drew proportionately more from other regions of Canada, 40 per cent and 36 per cent respectively, and the Atlantic and Prairie regions drew proportionately least, 23 per cent and 24 per cent respectively.

In the case of scientists, in contrast with the situation for engineers, the Atlantic region drew more from other Canadian regions, 42 per cent, and the Prairie region least, 21 per cent.

Table 7 also indicates the ratio of net loss or net gain in terms of employment by region. Briefly, the Atlantic region was a substantial net loser of engineers and scientists, but Ontario in the case of both engineers and scientists, and Quebec in the case of engineers, were substantial net gainers. Net loss in the Atlantic region was 70 per cent of engineers and 51 per cent of scientists employed in the Atlantic region. This means that after losses and gains are compared, the proportion of engineers "donated" by the Atlantic region to other parts of Canada was 70 per cent as great as the number actually employed in the Atlantic region. Ontario, on the other hand, gained a net of 20 per cent as many engineers as the number actually employed in Ontario. The Pacific region lost a net 13 per cent as many engineers as were employed there.

For scientists, all regions lost and only Ontario had a net gain, 18 per cent of all scientists employed in Ontario. The Atlantic region had a net loss of 50 per cent as many scientists as the number employed there. The Quebec and Pacific regions almost broke even, each having a net loss of 6 per cent as many scientists as were employed there.

The data also throw some light on the geographic mobility pattern in Canada. Table C—2 shows that Ontario and Quebec interacted strongly with a large proportion of graduates shown as "moving" between these two provinces. The Atlantic region and the Ontario and Quebec regions were also related with with interaction being more one-sided, i.e., usually "movement" from the Atlantic to the Central regions. The Prairie and Pacific regions interacted very little with the Atlantic region, but more with Ontario and Quebec and most of all with each other.

Another relationship which can be derived from Table C—2 is the regional variation in the ratio of scientists to engineers. The Prairie provinces had the highest ratio of scientists to engineers, nearly 9 to 10. The Atlantic and Pacific regions had slightly lower ratios of roughly 8 to 10 and 7 to 10 respectively. Ontario and Quebec had the lowest ratios with 5 to 10 and 4 to 10 respectively. The differences between

the ratios are functions of all the variables determining the province of employment of scientific and engineering personnel. One of the most important of these variables is undoubtedly the fact that a much higher percentage of engineers than scientists are working in private industry, and that Canadian industry is concentrated in Ontario and Quebec. Also, the inclusion of those with agricultural training in the group of scientists probably tended to increase the ratio of scientists to engineers in the agricultural regions of Canada.

Finally, the arrangement of the data in Tables 8 and C—2 allow a comparison of the amount of experience of engineers and scientists in various regions.

Table 8 — Proportion in Engineering and Science Who Received Bachelor's Degrees in the Ten Years Preceding the Survey, by Region of Employment in Canada, 1959

Region	Total		Those who received bachelor's degrees less than 11 years ago	
	No.	%	No.	%
Atlantic	717	100	387	54
Quebec	3,193	100	1,485	47
Ontario	6,023	100	2,931	49
Prairie	2,174	100	1,296	60
Pacific	1,274	100	650	51
All Canada	13,381	100	6,749	50

Source: Table C—2

Quebec had the lowest proportion of engineers and scientists who graduated within the last ten years — 47 per cent, and the Prairies the highest, 60 per cent. The contrast between the Prairie region and other regions of Canada was greatest in the case of engineers taken singly, with 63 per cent of those employed in the Prairie region in engineering graduating within the last 10 years.

What kinds of work are performed by engineers and scientists with different academic backgrounds?

The relation between course of study and kind of work done by engineers is illustrated in Table C—3. A strong association appears to exist between certain jobs and academic training. Those trained in aeronautical engineering, engineering physics, and metallurgical engineering showed a marked tendency to engage in research and development, with 25, 23 and 20 per cent respectively performing this function, compared to 6 per cent for engineers as a whole. Petroleum and chemical engineers had the largest proportion of their number engaged in production, operation and

maintenance, 44 and 31 per cent, compared to 16 per cent for engineers as a whole. Mechanical, geological and mining engineers were also higher than the average for all engineers in the proportion of their number engaged in production, operation and maintenance. Forest engineering with 36 per cent and mining engineering with 30 per cent had somewhat more than average engaged in executive and administrative work.

Looking at the data in Table C–3 in terms of the type of engineers engaged in particular functions, 79 out of 453, or 17 per cent of those employed as engineers and engaged in research and development, were trained in chemical engineering, although only 8 per cent of those employed as engineers were trained in chemical engineering. Mechanical engineers represented 197 out of 607, or 32 per cent of those engaged in sales, service, marketing and purchasing, although 21 per cent of those working in engineering were trained in mechanical engineering.

Information on course-job relationships for those employed in science fields is provided in Table C–4. Research and development was the most important area of activity for those trained in science, excluding agriculture and forestry, with 33 per cent engaged in this function. But there was a considerable amount of variation from specialty to specialty. Those trained in biological sciences and employed in science fields had the greatest proportion in research and development, just over half – 51 per cent, while scientists trained in physics were next with 45 per cent in this same function. Geological sciences had the lowest proportion in research and development, 16 per cent. Not unexpectedly, almost half of those trained in geological sciences, 46 per cent, were engaged in field exploration.

Almost 1 out of 4 of all scientists excluding agriculture and forestry scientists were engaged in teaching, 23 per cent, but here again the proportions varied widely. Fifty-eight per cent of scientists trained in mathematics were engaged in teaching, instruction and extension work, compared to only 6 per cent of those who received their training in the geological sciences.

Four per cent of those trained and employed in the science fields were in sales, service, marketing and purchasing, but in agriculture the proportion was highest at 10 per cent followed by general science with 7 per cent. General science was high in the function of testing, inspection and laboratory services, 17 per cent, followed by chemists trained in science with 15 per cent doing this same type of work.

The data in Table C–4 may be examined to determine what sciences represent the majority in particular functions. Although scientists trained and employed in chemistry and general science represented 983 out of 1,990 or 49 per cent of those in all science, excluding agriculture and forestry, they made up 156 out of 195 or 80 per cent of all those working in science and engaged in testing, inspection and laboratory services. Of scientists including those trained in engineering, agriculture and forestry employed in sales, service, marketing and purchasing, 129 out of 275 or

Table 9 — Comparison of Academic Background, Field of Employment Specilization and Selected Work Functions, Engineering and Science, 1959

Work Function	Trained Academically in Engineering		Trained Academically in Science	
	Employed in Engineering	Employed in Science	Employed in Engineering	Employed in Science
	%	%	%	%
Construction, Installation, Erection	30	5	16	Less than 1%
Production, Operation, Maintenance	16	16	13	5
Research, Development	6	27	17	33
Teaching	2	8	6	23

Source: Tables C–3 and C–4.

96362–8½

47 per cent were trained in agriculture, although only 28 per cent of all employed scientists had agriculture as an academic background, 1,249 out of 4,452.

A further relationship illustrated in Table 9 that may be of some interest was the difference in job activity of those with similar academic backgrounds, depending on whether they were employed in engineering or science specialties. The types of jobs performed by those trained in engineering and science depended to a much larger extent on the work environment than on academic background. To take just one function, only 6 per cent of those trained in engineering and employed in engineering jobs were in research and development, while 27 per cent of those trained in engineering but employed in science fields were engaged in this function.

The data on which this section of the report is based may be found in Tables 10 to 15 and in Tables B–8 and D–1.

How many scientific and technical professionals have taken post-graduate study?

The data for this question are given in Table 10 and B–8. In Table B–8 the data were analysed from the viewpoint of field of employment specialization and sex. The analysis in Table 10 is in terms of field of employment specialization and level of education. This table is closely comparable to Table 23 in Professional Manpower Bulletin No. 7 and the results are very similar.

Of all scientific and technical professionals, 18 per cent have obtained a master's or doctor's degree. The contrast between the level of education of engineers and scientists is once again evident, with only 1 per cent of all engineers compared to 24 per cent of all scientists excluding those in agriculture and forestry, holding doctor's degrees.

Within the general fields of engineering and science, there were substantial variations in the general level of education reached. For instance, only 6 per cent of the electrical engineers as compared to 20 per cent of the aeronautical engineers possessed advanced degrees. A large proportion of physicists and biologists held post-graduate degrees – 58 and 57 per cent respectively. A somewhat smaller proportion of chemists held master's and doctor's degrees, 32 per cent.

A male – female comparison (see Table B–8) indicated that in science, the proportion of women with advanced degrees was considerably lower than in the case of men. For example in science excluding agriculture and forestry, 24 per cent of the men and only 13 per cent of the women held doctor's degrees.

Where do scientific and technical persons receive their education?

Table D–1 indicates two broad patterns: first, a tendency for engineers and scientists who were born outside Canada to have both more experience and more education than the Canadian-born. Indeed, these two patterns may well be associated to some degree since some of the younger Canadian-born group, may not have had time to complete their post-graduate education.

In the case of engineers, 619 out of 7,018, about 9 per cent of the Canadian-born held post graduate degrees. A slightly higher percentage of engineers born in the United States or the United Kingdom held post-graduate degrees. But engineers born in countries other than Canada, the United States or the United Kingdom had by far the strongest tendency to hold post-graduate degrees, with 136 out of 571 or close to one-quarter holding such advanced degrees.

Table 10 – Education of Engineers and Scientists by Field of Employment Specialization and Level of Education, 1959

Field Employment Specialization	Level of Education									
	Total		No Degree		Bachelor's		Master's		Doctor's	
	No.	%	No.	%	No.	%	No.	%	No.	%
Aeronautical Engineering	174	100	5	3	134	77	30	17	5	3
Electrical Engineering	1, 714	100	26	1	1, 586	93	90	5	12	1
All Engineering	7, 158	100	126	2	6, 391	89	545	8	96	1
Biology	348	100	–	–	151	43	65	19	132	38
Chemistry	1, 293	100	9	1	871	67	161	12	252	20
Physics	365	100	2	1	151	41	107	29	105	29
All Science (excl. Agriculture and Forestry)	2, 767	100	13	*	1, 610	58	492	18	652	24
Architecture	503	100	14	3	442	88	41	8	6	1
All Other Fields	3, 939	100	24	*	3, 180	81	507	13	228	6
Total, All Fields	14, 367	100	177	1	11, 623	81	1, 585	11	982	7

Source: Table B–8.

* Less than ½ of one per cent.

In terms of level of experience, 3,655 out of 7,018 or 50 per cent of engineers born in Canada received a bachelor's degree within the last 10 years, compared to around 30 per cent of engineers born in either the United States or the United Kingdom. About 41 per cent, or 232 out of 571 of the engineers born in countries other than Canada, the United States or the United Kingdom at the bachelor degree level received their bachelor's degrees within the last 10 years.

The pattern in science is quite similar, with those born outside Canada having a higher level of education. For example, 1301 out of 4150 or about 31 per cent of scientists born in Canada held master's or doctor's degrees, compared to 141 out of 287 or 49 per cent of those born outside Canada, the United States or the United Kingdom. In terms of experience level, one-half, 2,070 out of 4,150 of the scientists born in Canada graduated within the last 10 years, compared to only 124 out of 287, or 43 per cent of those who were born outside either Canada, the United States or the United Kingdom.

Table 11 relates place of undergraduate education, level of university education and year the bachelor degree was obtained. A preponderant number of the professionals in engineering received their first degrees in Canadian universities, 7,971 out of 8,716, over 90 per cent. The remainder were divided almost equally among universities in the United States, the United Kingdom and elsewhere. The proportion who were Canadian-trained is negatively associated with level of experience. Almost 80 per cent, 976 out 1,209 with over 30 years' experience received first degrees from Canadian universities, compared to 6,582 out of 6,781 or 97 per cent of those who graduated in the last 10 years preceding the survey.

In view of the high immigration rate of professionally qualified persons in the last 10 years, the proportion of engineers trained outside Canada, 3 per cent, appears to be rather low especially when it is recognized that some of those who were trained outside Canada were Canadians who later returned to this country. The number of graduates in engineering from Canadian universities and colleges from 1950–1958 inclusive was 17,015, compared to net immigration of 7,667.[1] Net immigration represented almost one-third of the total increase in the supply of engineers during this period. Thus, there seems to be a lack of correspondence between intended occupation and actual occupation of immigrant engineers. A relatively small proportion of those immigrants whose intended occupation was engineering appeared to be actually practicing their professions, even after allowances are made for possible lags between entry into the country and professional recognition through professional association membership. Another possibility which the data do not illuminate is the professional qualifications of the immigrant engineers compared to those who are actually practicing engineering in Canada.

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[1] Dominion Bureau of Statistics, **Survey of Higher Education** and Department of Labour, Economics and Research Branch, **Graduating Class Surveys**. Department of Citizenship and Immigration, **Immigration Statistics**.

Table 11 – Location of Undergraduate University by Level of Education and Years from Bachelor Graduation, Engineering, 1959

Location of Undergraduate University by Level of Education	Engineering							
	Total		Years from Bachelor Graduation					
			Over 30		11–30[1]		1–10	
	No.	%	No.	%	No.	%	No.	%
Canada, Total	7,971	100	634	8	3,069	38	4,268	54
No Degree	53	100	–	–	53	100	–	–
Bachelor's	7,203	100	575	8	2,692	37	3,936	55
Master's	589	100	42	7	253	43	294	50
Doctor's	126	100	17	14	71	56	38	30
United States, Total	228	100	64	28	122	54	42	18
No Degree	11	*	–	–	11	*	–	–
Bachelor's	192	100	55	29	100	52	37	19
Master's	23	*	9	*	11	*	3	*
Doctor's	2	*	–	–	–	*	2	*
United Kingdom, Total	268	100	44	16	158	59	66	25
No Degree	57	100	–	–	57	100	–	–
Bachelor's	176	100	33	19	85	48	58	33
Master's	29	*	9	*	14	*	6	*
Doctor's	6	*	2	*	2	*	2	*
Other Countries, Total	244	100	62	25	153	63	29	12
No Degree	7	*	–	–	7	*	–	–
Bachelor's	151	100	40	27	91	60	20	13
Master's	64	100	14	22	43	67	7	11
Doctor's	22	*	8	*	12	*	2	*
Total, All Countries	8,711[2]	100	804	9	3,502	40	4,405	51

Source: Survey of Scientific and Technical Personnel, 1959.

[1] Includes 128 with no degree, who therefore did not state year of graduation.

[2] See Appendix 4 for groups excluded.

* Base numbers too small to compute percentages.

The level of education of engineers who were trained outside Canada was somewhat higher than that of the Canadian-trained. The proportion of those trained in Canada with advanced degrees was 715 out of 7,971, or 9 per cent. Twenty-five out of 228, or 11 per cent of the engineers employed in Canada who were trained in the United States held post-graduate degrees, compared to 15 per cent and 35 per cent respectively for engineers trained in the United Kingdom or in countries outside either Canada, the United States or the United Kingdom.

The difference shown in Table 11 in the level of experience between the Canadian and foreign-trained engineers is especially striking and is similar to the pattern shown in Table D–1 which is arranged in terms of place of birth of engineers. For example, over one-half – 4,268 out of 7,971 – of the Canadian-trained engineers received their bachelor's degrees in the 10 years preceding the survey. But only 42 out 228 of the engineers employed in Canada who were trained in the United States graduated in the preceding 10 year period. Twenty-five per cent of engineers educated in the United Kingdom and employed in Canada and only 12 per cent of the engineers trained in countries outside either Canada, the United States or the United Kingdom and employed in Canada received their bachelor's degrees in the 10 year period preceding the survey.

Table 12 shows that the proportion in science of the Canadian-trained was higher than in engineering, around 95 per cent – 4,667 out of 4,934. The proportion of those who were trained in Canada rises steadily as level of experience increases. Of those with over 30 years experience, 84 per cent or 342 out of 405 were Canadian-trained, compared to 2,314 out of 2,376, or 97 per cent of those with 10 years' experience or less.[1]

As in the case of engineers, scientists educated in foreign countries had a higher level of education than those trained in Canada. For example, almost one-third, 1,498 out of 4,667 of the Canadian-educated scientists held advanced degrees, compared to 65 out of 95 or over two-thirds of those trained in places other than Canada, the United States or the United Kingdom. In the case of those trained in the United States, the United Kingdom and other countries, the proportions shown with master's or doctor's degrees are probably subject to a greater than usual margin of error owing to the relatively small numbers of persons represented by the data.

The classification by experience level for scientists reveals a similar pattern for the Canadian and foreign-trained as in the case of engineers, with between 18 and 25 per cent of the foreign-trained compared to 50 per cent of the Canadian-trained scientists graduating in the 10 years prior to the survey.

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[1] Immigration data do not permit a comparison of immigrants in science with those actually engaged in these professions.

Table 12 – Location of Undergraduate University by Level of Education and Years from Bachelor Graduation, Science, 1959

Location of Undergraduate University by Level of Education	Science							
	Total		Years from Bachelor Graduation					
			Over 30		11–30[1]		1–10	
	No.	%	No.	%	No.	%	No.	%
Canada, Total	4,667	100	342	7	2,011	43	2,314	50
No Degree	29	*	—	—	29	*	—	—
Bachelor's	3,140	100	192	6	1,184	38	1,764	56
Master's	782	100	63	8	391	50	328	42
Doctor's	716	100	87	12	407	57	222	31
United States, Total	67	100	15	22	39	58	13	20
No Degree	3	*	—	—	3	*	—	—
Bachelor's	40	100	8	20	22	55	10	25
Master's	9	*	3	*	5	*	1	*
Doctor's	15	*	4	*	9	*	2	*
United Kingdom, Total	105	100	26	25	47	45	32	30
No Degree	4	*	—	—	4	*	—	—
Bachelor's	46	100	12	26	15	33	19	41
Master's	18	*	7	*	6	*	5	*
Doctor's	37	100	7	19	22	59	8	22
Other Countries, Total	95	100	22	23	56	59	17	18
No Degree	2	*	—	—	2	*	—	—
Bachelor's	28	*	5	*	18	*	5	*
Master's	28	*	5	*	17	*	6	*
Doctor's	37	100	12	33	19	51	6	16
Total, All Countries	4,934[2]	100	405	8	2,153	44	2,376	48

Source: Survey of Scientific and Technical Personnel, 1959.

1 Includes 38 with no degree, who therefore did not state year of graduation.

2 See Appendix 4 for groups excluded.

* Base numbers too small to compute percentages.

Table 13 – Location of Undergraduate University, Engineering and Science, 1959

Location of Undergraduate University	Total		Engineering		Science	
	No.	%	No.	%	No.	%
Canada, Total	12,470	93	7,863	93	4,607	95
Atlantic	1,121	8	645	8	476	10
Quebec	2,559	19	1,626	19	933	19
Ontario	4,821	36	3,227	38	1,594	33
Prairies	2,697	20	1,619	19	1,078	22
Pacific	1,272	10	746	9	526	11
United States	273	2	210	2	63	1
United Kingdom	310	2	211	2	99	2
Other Countries	328	3	236	3	92	2
Total	13,381	100	8,520	100	4,861	100

Source: Table C–2

Table 14 – Region of Undergraduate University by Region of Post-Graduate University, Engineering and Science, 1959

Region of Undergraduate University	Total		Region of Post-Graduate University			
			Canada		Other	
	No.	%	No.	%	No.	%
Engineering, Total	645	100	371	58	274	42
Canada	528	100	362	69	166	31
Other Countries	117	100	9	8	108	92
Science, Total	1,614	100	984	61	630	39
Canada	1,464	100	952	65	512	35
Other Countries	150	100	32	21	118	79
Engineering and Science, Total	2,259	100	1,355	60	904	40

Source: Survey of Scientific and Technical Personnel, 1959.

Table 13 shows that 93 per cent of engineers and scientists employed in Canada took their undergraduate education in Canada and 7 per cent studied elsewhere. The engineer-scientist differentials are not large, with 7 per cent of the engineers having studied outside Canada, compared to 5 per cent of those in science.

Regionally within Canada, of all engineers and scientists who were educated in Canada, 4,821 out of 12,470, or 39 per cent, were trained in Ontario. When this proportion is compared to the proportion of Ontario to Canadian population as given in the 1956 Census – 33.6 per cent – it is apparent that Ontario educates a considerably larger proportion of engineers and scientists than is indicated on the basis of population alone. In the case of engineering, the proportion educated in Ontario was even higher, 3,227 out of 7,863, or 41 per cent.

Although Quebec on the other hand had 28.8 per cent of Canadian population (1956 Census), only 2,559 out of 12,470, or about 20 per cent of engineers and scientists reporting in the survey were educated there on the undergraduate level.

Table 14 compares place of undergraduate and place of post-graduate training of those engineers and scientists employed in Canada who received post-graduate education. About 2 out of every 5 engineers and scientists with post-graduate education who were employed in Canada, received their post-graduate education in foreign countries. When taken separately the proportions of engineers and scientists educated outside Canada are almost identical, about 2 out of 5 in each case.

The tendency of engineers educated in Canada at the undergraduate level to go outside Canada for advanced study is also indicated. About 1 out of 3 engineers presently employed in Canada who received their undergraduate education in Canada, took their post-graduate education elsewhere.

For scientists educated in Canada, a slightly higher proportion than in the case of engineers tended to go outside Canada for post-graduate education, over 1 out of 3.

Nothing in the data on engineers or scientists indicates to what extent Canadians go outside Canada for both undergraduate and post-graduate study since the data on those who received undergraduate education outside Canada do not distinguish immigrants from Canadian citizens. It should also be pointed out that these data apply only to engineers and scientists now employed in Canada, and therefore do not give a complete picture of the education-employment pattern over time as between Canada and other countries. Engineers and scientists who were educated in Canada and who later emigrated and became United States citizens, for example, are not part of the Register and are, therefore, not included in the survey.

Table 15 – Industry by Level of Education, Engineering and Science, 1959

Industry[1]	Total		Level of Education							
			No Degree		Bachelor's		Master's		Doctor's	
	No.	%	No.	%	No.	%	No.	%	No.	%
Engineering										
Private Industry[2]	6,837	100	11	*	6,282	92	464	7	80	1
Manufacturing	3,124	100	7	*	2,882	92	209	7	26	1
Universities	191	100	—	—	79	41	80	42	32	17
Government	1,396	100	3	*	1,204	86	147	11	42	3
Federal Government	737	100	—	—	609	83	96	13	32	4
All Other Industries	66	100	—	—	62	94	4	6	—	—
Total, All Industries	8,490[3]	100	14	*	7,627	90	695	8	154	2
Science										
Private Industry[2]	2,271	100	4	*	1,791	79	284	13	192	8
Manufacturing	1,086	100	—	—	853	79	141	13	92	8
Universities	457	100	—	—	74	16	93	20	290	64
Government	1,586	100	1	*	907	57	368	23	310	20
Federal Government	992	100	1	*	441	45	272	27	278	28
All Other Industries	529	100	—	—	435	82	86	16	8	2
Total, All Industries	4,843[3]	100	5	*	3,207	66	831	17	800	17

Source: Survey of Scientific and Technical Personnel, 1959.

1 See Appendix 2 for explanation of industry groups.

2 Includes those engaged in professional service.

3 See Appendix 4 for groups excluded.

* Less than ½ of one per cent

Which employers have the highest proportion of scientific and technical professionals with post-graduate degrees?

Universities and governments together employed 688 out of 1,526 or 45 per cent of all scientists and engineers with master's degrees and 674 out of 954 or 71 per cent of those with doctor's degrees as shown in Table 15.

Engineers and scientists employed by universities were most likely to have post-graduate degrees, and those employed in the manufacturing sector least likely. The proportion of engineers with post-graduate degrees employed by universities, governments and in manufacturing were respectively 59, 17 and 8 per cent. For scientists, the proportions holding post-graduate degrees and employed in the corresponding sectors, universities, governments, and manufacturing were 84, 55 and 21 per cent respectively.

APPENDICES

APPENDIX I

The National Register of Scientific and Technical Personnel History, Operation and Sample Surveys of Registrants

The Department of Labour maintains individual records of a large proportion of the scientific and technical personnel in Canada through enrolment in the Register of Scientific and Technical Personnel. Surveys are undertaken periodically to keep the Register up to date and to obtain information on those enrolled in the Register.

History

The Register and the surveys connected with it are a continuation and development of the operations of the Wartime Bureau of Technical Personnel, which was set up in 1941 as the Federal Government's employment agency for technical personnel. The primary function of the Wartime Bureau was the placement of engineers and scientists into employment where they could render the greatest service in the war effort. Through this work the Bureau acquired first-hand knowledge of employment conditions in technical fields. In addition to the direction of professional manpower, individual files were established for some 35,000 technical persons based on data obtained through compulsory wartime registration. Wartime experience provided a fund of knowledge and a basis for subsequent Register and research work.

Under wartime regulations, enrolment in the Register was mandatory for all persons with professional status in engineering, architecture, biology, chemistry, geosciences, mathematics, physics, agriculture, forestry and veterinary medicine.

Changed conditions at the end of the war meant changes in the work of the Bureau. The resettlement of technical personnel from the armed forces and defence industries became its main preoccupation.

When wartime controls were relinquished, the Register was retained because of its possible value in any future emergency, and because it was a major source of information on scientific and technical persons. But after the war, enrolment became voluntary and enrolment has been maintained since that time on a voluntary response basis with the assistance of universities and professional associations.

The year 1947 marked a turning point in the operations of the Wartime Bureau. In April of that year it was decided that the placement operation should be transferred to the Executive and Professional Section of the Unemployment Insurance Commission, but that the records of that national roster would be retained in the possession of the Department of Labour.

The period from 1947 to 1951 formed another distinct stage in the work of the Bureau, or the Technical Personnel Division as it was called until 1950 when it became part of the Economics and Research Branch,

Maintaining the records of the National Register was a large task, since it was necessary to have the name, address and specialization for a person to be considered in the active Register. Records were kept of the additions to the pool of technical personnel through university graduations and by 1951 some 23,000 names had been added in this manner. The Register came to include approximately 49,000 names by March 1950.

Various projects of a research nature were inaugurated in the post war years. Studies were made of the income level of those in the Register. The potential market for engineering and scientific manpower was surveyed. Summer employment opportunities for undergraduates in technical courses were assessed. Much of the material resulting from these and other studies was published in the quarterly Technical Personnel Bulletins.

There were some indications in 1951, with the outbreak of the Korean War, that an emergency might be at hand. Since the main purpose of maintaining the Register records was its value as an effective instrument in manpower mobilization in the event of an emergency, a re-survey of registrants was undertaken in that year in order to get more detailed and up-to-date information, particularly on qualifications and skill. This survey took on the characteristics of a continuing operation for several years after 1951 and the number in the Register climbed to 69,000.

In 1957, a change in the procedure and purpose of the survey operation was made. It was decided to get in touch with one-third of the Register each year and this three-year cycle survey would serve a dual purpose. It would obtain certain information required for Register purposes as well as other data which would facilitate analysis of the employment and income characteristics of the scientific and technical group. These purposes were assisted by companion surveys, one a biennial forecast of industry's requirements and the other concerned with the education and future plans of graduating classes.

The 1959 survey marked the completion of the first cycle in the three-year cycle survey. Over the three-year period questionnaires were mailed to almost 60,000 scientific and technical professional out of 75,000 in the Register. Replies were received from close to 40,000. The first survey in the second round was made in 1959–60.

Efforts are continuing to expand coverage by the addition of new names based on lists supplied by various professional associations.

In addition to the regular cycle and companion surveys, the Department is undertaking joint surveys of particular professions annually in co-operation with the Canadian Institute of Forestry, The Royal Architectural Institute of Canada, and The Chemical Institute of Canada. Two joint surveys have already been done of Canadian Institute of Forestry members. The first joint surveys of members of the other two associations are scheduled for early in 1961.

Operation

As noted in the Introduction, the Register includes all professionally qualified persons in engineering, science, architecture and veterinary medicine who are Canadian citizens or non-Canadians working in Canada. These persons must be either graduates of a recognized course in the above specialties or must have passed qualifying examinations set by the registering body in the professions.

Returns completed by new university graduates have been the chief source of additions to the Register since compulsory registration was discontinued. The generally large response from university graduates has made it possible to maintain a high coverage. Immigrants and Canadians educated in other countries are enrolled in the Register mainly on the basis of membership records of professional associations, referrals by a limited number of the larger corporations, and in part also through referrals by the Executive and Professional Section of the National Employment Service, and by the Settlement Offices of the Department of Citizenship and Immigration.

Sample Survey Procedures

The universe of scientific and technical professionals surveyed by the Department is covered by means of a three-year cycle survey operation. To accomplish this, the universe is divided into three equal parts in a fashion which insures that each is representative of the whole. Every year questionnaires are sent to all those in one of the three parts, and in this way all are covered in a three-year period.

A sampling approach was adopted for three basic reasons. First, it reduced considerably the annual costs of conducting a survey of this kind and of maintaining a National Register of engineers and scientists on an up-to-date basis. The cost element was particularly important because the universe covered is a growing one, with the result that survey costs were bound to mount over the years. Second, it meant that individual respondents would be asked to complete questionnaires only once every three years. Thus, any possibility of the survey encountering a growing measure of respondent resistance because of annual inquiries about matters which in many cases might not have changed since the previous year could be reduced. Third, the use of stratified sampling procedures meant that annual data could be obtained which represented the whole universe within limits of sampling variation.

In selecting the sampling methods to be employed, consideration had to be given to the characteristics being investigated. The main requirements were to insure that the sample would be representative of each profession, of each province, and of all experience levels in terms of years since graduation or since professional status was obtained in other ways. These requirements were achieved by stratifying the whole universe according to each of the above characteristics and, within each stratum arranging the individuals alphabetically by surname and then dividing them in sequence into three groups. This latter step was taken by number-

ing the alphabetically arranged individuals 1, 2, 3, 1, 2, 3, ..., and then consolidating all the 1's, 2's and 3's into separate groups. The group surveyed each year, therefore, consists of a one-third stratified random sample of the total universe.

An illustration of the application of these principles to the survey operations can be seen in the methods followed in bringing in new additions to the survey each year. The great majority of those to be added come from lists of the graduating classes in engineering and science in universities in Canada and the United States. Following the principles above, questionnaires which have been received from the graduates-elect in a separate survey are organized by university, course and year of graduation. They are given numbers in sequence which will assign them to one of the three sampling divisions. For example, all graduates from the University of Alberta in civil engineering in 1958 would be divided into three equal parts to be surveyed later in the cycle operation. In this manner, the principles of stratification by place, specialty and year are actually carried out in practice.

The same principles are applied to those who are not university graduates but who have become qualified by passing examinations. That is to say, those to be added are organized according to the branch of the profession and province in which they passed examinations and by the year in which they were registered.

There are two other groups of a special type who are added to the survey in small numbers from time to time. These are professionally qualified immigrants or registrants with the National Employment Service. Although arrangements have been established to obtain information on such professionals, the number so far added from these sources has not been large. It has not been possible to stratify these by academic specialty or by year of graduation or equivalent, and so they have been introduced into the sample solely on the basis of random selection.

The particular segment to be surveyed each year is mailed questionnaires and in the case of the most recent survey, 1959–60, the nonrespondents to the first mailing were followed up by a second mailing six weeks later and this procedure was repeated in a third follow up mailing four weeks later. The effect of this procedure appears to be reflected in an increased rate of over-all response. The results of increased efforts to obtain response to the survey questionnaire have been outlined in the introduction to this report.

APPENDIX II

Notes on Concepts and Definitions Used in the Survey of Scientific and Technical Personnel

Comparison of Specialty Groupings by Field of Employment and by Academic Course

The specialty groupings which are used are derived in turn from coded lists in which both employment field and academic courses are listed in greater detail than those actually used in the final tables. The groups used represent a compromise between the requirements for detail and the need to use large enough groupings for the data to be meaningful.

The respondents to the survey selected the field of employment specialization from a list of 695 sub-specialties comprising 10 engineering fields, 8 science fields, plus architecture and veterinary medicine, plus a residual group of miscellaneous specialties.

On the basis of undergraduate academic course, the respondents were coded and arranged into 36 university courses--16 engineering, 16 science, architecture, veterinary medicine, one miscellaneous science course grouping and one comprising non-engineering and non-scientific courses.

Specialty Codes Used in the Survey of Scientific and Technical Professions, 1959–60

Schedule 2 – University Courses

Engineering

01 Aeronautical (including Aerophysics)
02 Agricultural
03 Chemical (including Ceramic; and Chemistry in the Faculty of Applied Science at Queen's)
04 Civil (including Municipal; Sanitary; Traffic and Highway)
05 Electrical (including Electrical and Electronic)
06 Engineering and Business
07 Engineering Physics (including Physics in the Faculty of Applied Science at Queen's)
08 Forest
09 General
10 Geological (including Applied Geology)
11 Mechanical (including Applied Mechanics; Industrial; Mechanical Sciences; Naval Architecture and Marine; Textile)
12 Metallurgical (including Metal Sciences)
13 Mining
14 Nuclear
15 Petroleum
29 Other (including Electro-Mechanical; Guided Missiles; etc.)

Architecture

30 Architecture (including Community and Regional Planning)

Science

40 Agriculture (including Agronomy; Animal Husbandry; Dairying; Food Technology; Horticulture; Soils).
41 Bacteriology (including Bacteriology and Immunology; Microbiology)
42 Biochemistry (including Physiology; Physiology and Biochemistry)
43 Biology (including Fisheries; Genetics; Genetics and Physiology; Pathology)
44 Botany
45 Chemistry (including Food Chemistry)
46 Chemistry and Physics
47 Forestry
48 General Science (including General Honours Course in Science at Queen's)
49 Geography
50 Geology (including Geochemistry; Geophysics; Mineralogy)
51 Mathematics
52 Mathematics and Physics (including Astronomy; Meteorology)
53 Metallurgical Science
54 Physics (including Nuclear and Atomic Physics)
55 Veterinary Medicine (including Veterinary Science)
56 Zoology (including Entomology)
70 Other Science (including Biology and Chemistry; Chemistry and Geology; Chemistry and Mathematics; Physics and Biochemistry; Physics and Geology; Physics and Physiology; etc.)
90 Non-engineering and non-scientific courses

Classification of Fields of Employment Specialization

Section 1 – Architecture, Sciences and Veterinary Medicine		Section 2 – Engineering	
Architecture	0100–0199	Aeronautical	4000–4099
Agriculture	1000–1099	Chemical	4200–4299
Biological Sciences	1200–1299	Civil	4400–4499
Chemistry	1400–1499	Electrical	4600–4699
Forestry	1600–1699	Industrial	4800–4899
Geography	1800–1899	Mechanical	5000–5099
Geoscience	2000–2299	Metallurgical	5200–5299
Mathematics	2400–2499	Mining	5400–5499
Physics and Engineering Physics	2600–2699	Naval Architecture and Marine	5600–5699
Veterinary Medicine	3000–3099	Petroleum	5800–5899

Other Scientific and Technical Fields 9010–9099

Lists of the course and employment specialty groupings as they were originally coded are given above. The 695 sub-specialties are not given here. Four main types of groupings were made on the basis of the coded lists.

1. Engineering-Science
2. Engineering-Science-Architecture-Veterinary Medicine
3. Engineering-Science-Agriculture-Architecture-Forestry-Veterinary Medicine
4. Engineering-(detailed) Science-(detailed) Agriculture-Architecture-Forestry-Veterinary Medicine

1. *Engineering-Science*

(a) Field of Employment Specialization

The engineering group includes all 10 engineering fields which were coded. The science group includes all the other fields except architecture, veterinary medicine, and the miscellaneous group "other scientific and technical fields".

(b) Academic Course Specialty

The engineering groups include all 16 engineering groups on the coded list. Science includes all the other course specialties, 17 in number except architecture, veterinary medicine, and non-engineering and non-scientific courses.

2. *Engineering, Science, Architecture, Veterinary Medicine*

The groupings here are the same as in the case of engineering-science with the exception that architecture and veterinary medicine are added.

3. ***Engineering, Science, Agriculture, Architecture, Forestry, Veterinary Medicine***

In this case the agriculture and forestry specialties are not included in the science groups, but are listed separately.

4. ***Engineering (detailed), Science (detailed), Agriculture, Architecture, Forestry, Veterinary Medicine***

(a) Field of Employment Specialization

The 10 engineering fields on the coded list are reduced to 8 by grouping industrial engineering and naval architecture and marine engineering with mechanical engineering.

The science fields are the same as on the coded list. Group totals given for science include only biological science, chemistry, geosciences, mathematics, and physics and engineering physics, since agriculture and forestry are listed separately.

(b) Academic Course Specialty

In most cases the coded list was reduced in size by grouping the courses. The engineering group of 16 was reduced to 12 by grouping agricultural engineering, engineering and business, general engineering and nuclear engineering with the miscellaneous "other" category.

The 17 science codes were reduced to 10 by grouping botany and zoology with biology and by putting bacteriology, biochemistry, chemistry and physics, geography, and metallurgical sciences with the miscellaneous "other" group of sciences. Architecture and veterinary medicine are listed separately.

It will be noted that engineering physics is classified differently under the field of employment and academic course approaches. In the employment specialty groups, engineering physics is included with physics. In the groups based on academic course, engineering physics is part of the engineering group.

Groupings by Level of Education

The level of education was ascertained by having the respondents code themselves into four categories on the basis of the highest level of education attained. The four categories were: no university degree; bachelor's; master's; doctor's. In this survey in most cases, the information sought was on higher degrees beyond the bachelor level, since the information on bachelor education or less was obtained in the majority of cases from previous questionnaires received when the respondents entered the Register.

The categories are as follows:

	(	No college or university training
No degree	(	Some college or university training, less
	(	than bachelor's

Bachelor's	(	Bachelor's(B.A., B.Sc., B.Eng., B.A.Sc., D.V.M., etc.)
	(	Bachelor's plus post-graduate training
Master's	(	Master's(M.A., M.Sc., M.A.Sc., M.V.Sc.)
	(	Master's plus some post-graduate training
Doctor's	(	Doctor's(Ph.D., D.Sc., etc.)
	(	Doctor's plus additional post-graduate
	(	training or additional doctor's degrees

It will be observed that first professional degrees such as B.A.Sc. and D.V.M. are considered as bachelor level degrees.

Industry Combinations

The industrial classification in the coded list of 56 industries given below is based on the respondents' indications of "principal employer". The coding was done on an industrial basis by establishment. The classification used is based on the Standard Industrial Classification Manual of the Dominion Bureau of Statistics, 1948. The coding is based as far as possible on the List of Establishments of the Dominion Bureau of Statistics.

– No answer

Primary Industries (Other than Mining)

01 Farming (000–079)
08 Forestry (080–089)
09 Fishing, Hunting, Trapping (091–097)

Mining

10 Gold Mining (101–103)
11 Other Metals (Ferrous and Non-ferrous) (107–119)
12 Coal, Oil and Gas (121–126)
13 Non-metals (Asbestos, Gypsum, Salt, etc.) (131–139)
15 Quarrying (Granite, Limestone, Sand and Gravel, etc.) (153–159)
17 Prospecting and Exploration (172–179)

Manufacturing

20 Foods, Beverages, Tobacco (200–230)
23 Rubber (236–239)
24 Leather (241–249)
25 Textiles and Clothing (251–279)
28 Wood Products (281–289)
29 Paper Products (292–299)
30 Printing and Publishing (301–309)
31 Iron and Steel Products (311–329)
33 Transportation Equipment (Aircraft, Ships, Motor Vehicles, Railways) (330–339)
34 Non-ferrous Metal Products (Aluminium, Brass, White Metals, etc.) (341–349)
35 Electrical Apparatus (351–359)

Manufacturing (cont'd.)

36 Non-metallic Mineral Products (Abrasive, Asbestos, Clay, Stone, etc.) (361–369)
37 Products of Petroleum and Coal (incl. Petroleum Refining) (373–379)
38 Chemical Products (380–389)
39 Miscellaneous (Brooms, Instruments, Toys, Fabricated Plastics, etc.) (391–399)

Construction

40 All types of Construction and Contractors, etc. (404–439)

Transportation, Storage and Communication

50 Air (501)
51 Bus, Truck and Taxi (i.e., "Highway") (505–514)
52 Railways, Steam and Diesel (508) (except Telegraph)
53 Street Railways (Urban and Suburban. Subway and Trolley Buses) (510)
54 Water (516–518)
55 Grain Elevators and Storage (524–527)
56 Radio and Television (543)
57 Telephone (547)
58 Telegraph (Railway Communication Service) (508)
59 Others (e.g., Oil Pipeline Operation) (517–519–549)

Public Utilities (Other than Transportation and Communication)

61 Electric Light and Power (602)
62 Gas (604)
63 Water and Sanitary Services (608)
64 Other (609)

Trade

70 Wholesale (701–729)
73 Retail (incl. Department Stores) (731–799)

Finance, Insurance and Real Estate

81 Banking (802)
82 Investment, Loan and Trust Companies (incl. Stocks, Bonds) (804)
83 Life Insurance (806)
84 Non-life Insurance (808)
85 Real Estate (809)

Service

90 Community or Public Service (903–909) except university, college and high school level institutions
91 Government Armed Forces (911) members of the regular forces
92 Recreation Service (922–924)
93 Business Service (932–939)

Service (cont'd.)

94 Personal Service (941–949)
95 Universities (901) Univ. and college - level institutions
96 Dominion Government (911–916) excluding members of the regular forces
97 Municipal and Other Local Government (917)
98 Provincial Government (918)
99 High Schools, Technical and Commercial High Schools, Technology Institutes (selected from the 901 category)

In order to permit more meaningful groupings, the list of 56 industries above was grouped still further into three main types: Industry (25); Industry (7); Industry (5); Industry (4).

Industry (25)

Primary (except mining)
Mining
Manufacturing
- Foods, Beverages and Tobacco
- Rubber, Leather and Textiles
- Wood Products
- Paper Products
- Iron and Steel Products
- Transportation Equipment
- Non-Ferrous Metal Products
- Electrical Apparatus
- Non-Metallic Mineral Products
- Petroleum and Coal Products
- Chemical Products
- All other Manufacturing

Construction
Transportation, Storage and Communication

Public Utilities

Trade, Finance, Insurance, Real Estate

Business (Professional) Service

Universities

Governments
- Federal Government
- Local Governments
- Provincial Governments

High Schools

Other Service Industries

It will be observed that the above grouping is based mainly on the divisions of the Standard Industrial Classification List, with further

breakdowns on the basis of major groups and sub-groups where that was thought to be desirable. In the case of the manufacturing division the groupings are based mainly on major groups. The only combination that does not appear to be obvious is a grouping of printing and publishing with the miscellaneous group at the end. In the service division the only groupings that appear to require comment are the groupings of government armed forces with dominion (federal) government, as well as the grouping of community or public service with recreation service and personal service.

Industry (7)

Business (Professional) Service
Universities
Federal Government
Municipal and other Local Government
Provincial Governments
High Schools, Technical and Commercial High Schools, Technology Institutes
Others (all industries not included in the above categories, usually referred to as "private industry")

It may be mentioned that the "private industry" grouping above includes community or public service except universities, recreation service, and personal service.

Industry (5)

Business (Professional) Service
Universities
Governments
High Schools, Technical and Commercial High Schools, Technology Institutes
Others (all industries not included in the above categories)

The main difference between this list and the one immediately above is that in this listing the three levels of government have been combined into one. It should also be noted that, following the usage in the Standard Industrial Classification Manual, the "private industry" group includes certain government-owned and operated establishments which are engaged in activities assigned to particular industries, for example, government-owned railroads, electric generating stations and so on.

Industry (4)

In a few cases business service has been combined in the residual category comprising private industry.

APPENDIX III

Investigation of Non Respondents in the Survey of Scientific and Technical Personnel, 1958–1959

Introduction

As is noted in the introduction to this bulletin, not all of the 22,784 scientific and technical personnel who were sent questionnaires returned them. The Department has for some time been interested in the possibility that the non-respondents (those who did not reply) are different from those who did reply. If such were the case, conclusions based on the usual cycle material would be in error to some degree because the material would not be fully representative of the total group of respondents plus non-respondents. If, for example, all persons with incomes under $3,000 per year failed to reply, the survey figure on incomes would have an upward bias of some magnitude.

There are two basic causes of non-response and therefore two possible types of non-response bias. The first results from the non-receipt of a questionnaire. A person who has moved and cannot be located by the post office does not have a chance to reply. The second type arises when a person who has received a questionnaire fails to fill it in and return it. There is considerable reason to expect that both types of non-respondents will differ in some respects from those who both received and returned the questionnaire. the magnitude of these two types of non-response is shown in the table below for the past three surveys.

	1957–1958 Cycle II	1958–1959 Cycle III	1959–1960 Cycle I
Percentage who did not receive questionnaire	16.0	12.6	7.4
Percentage of those receiving questionnaire who failed to return it *(See ref. p. 76)	24.9	21.4	19.4

It can readily be seen that the non-response due to non-receipt of the questionnaire has been considerably reduced by administrative improvements but that the non-response caused by non-return has proven to be less easily reducible.

Since it seems apparent that the non-response caused by non-return cannot be greatly reduced in the near future, it was decided to examine the characteristics of this type of non-respondent to see whether, and to what degree, they differed from those who do respond. No investigation has been made of the non-response due to non-delivery of the questionnaire.

The approach was to attempt to determine (a) In what ways do non-respondents differ from respondents? (b) In cases where the respondents and non-respondents do differ, to what degree does this affect estimates made from the cycle survey? To choose a purely hypothetical example: if half of the respondents are left-handed and one-third of the non-

respondents are left-handed, what percentage of the total of respondents plus non-respondents is left-handed? i.e., What is the true percentage of left-handed people in the group who received questionnaires?

The method used

The method used was an adaptation of that outlined by El-Badry.[1]

After the regular survey had been completed in 1959, 4,900 persons who received questionnaires had not yet responded. One quarter of these, (1,250) were sent another questionnaire and 422 responded. The remainder who has still not replied were sent registered letters and a further 204 replied. An attempt was made to sample the remainder (the "hard core"), but the sample was not random and so could not be used in determining bias or in determining true values.

The over-all result of these operations was to produce three usable groups of questionnaires--the "cycle" group of approximately 17,200, the "A's" of 422, and the "registers" with 204.

Before the presence of bias in regard to any characteristic (e.g. the percentage of engineers and the total, the percentage who are self employed, etc.) could be determined, it was necessary to make the categories correspond as closely as possible to those used in cycle survey reports. Since all the data and most definitions used here refer to Cycle III (1959) (which was not published) application of the results to other survey reports must be made with caution.

Each year certain groups are removed from the survey operations or from the published results of the survey data, or both. In this way both the survey itself and the tabulations based on it are restricted as far as possible to those engaged in scientific and technical professions. In the 1958 survey of scientific and technical professions, a number of persons were not included in the statistics based on the survey report. These may be designated as the "removals"[2]. In order to make the "cycle", the "A" and the "register" groups comparable, the "removals" were subtracted from each of the above groups. The estimated number of removals were also deducted from the "hard core" group.

The method used for determining the presence of bias in any characteristic was to compute (after subtracting the removals) the percentage of each of the cycle, the A's and the registers who possessed some characteristic, "X". The percentages were compared to see whether they differed. If all three groups had the same percentage of "X" then there was obviously no bias. If the percentages differed a simple statistical test was applied to determine whether the difference was significant at the 95 per cent confidence level.

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[1] M.A. El-Badry, "A Sampling Procedure for Mailed Questionnaires", Journal of the American Statistical Association, 1956, pp. 209—227.

[2] Defined as: students, housewives, retired, non-technical personnel, 1958 graduates, persons not living in Canada, persons not practising their profession, and those who indicate "other" as their employment status.

If the differences in the percentage of "X" in the cycle, A's and registers were significant at the 95 per cent level, it was taken as a clear indication that non-response bias existed in regard to the "X" characteristic. In such a case, any estimate of the percentage of the population possessing the "X" characteristic made on the basis of the "cycle" figures alone would be in error. In order to determine the extent of such an error, the "true" percentage in the population was estimated.

The method of determining the "true" percentage in the entire population which possessed the "X" characteristic is rather detailed. A precise statement can be found (with respect to the population mean) in El-Badry's article previously referred to. In more general terms, the procedure was to obtain a weighted average of the three groups and the "hard core". Since the actual percentage of "X" in the "hard core" is unknown, two different assumptions were made about it. The first assumption was that the "hard core" non-respondents did not differ from a weighted average of the cycle, A's and registers. The second assumption was that any trend observable from the cycle to the A's to the registers would be even more strongly continued in the "hard core". Since these two assumptions lie at opposite extremes, it seems likely that the actual percentage of the "hard core" who possess the characteristic "X" will fall somewhere between them. The result of the necessity to make assumptions about the "hard core" is that, in each case, two "true" values were computed.

To sum up, in each case two true values were computed for each characteristic, based on extreme assumptions about the nature of the "hard core". It seems likely that, if the nature of the "hard core" group were fully known, the actual population value would be found to lie between the two "true" values estimated in each case.

Results

In each subsection below, a statement is made as to whether there is non-response bias in regard to each characteristic (where the respondents differ significantly from the non-respondents). In each case where such bias exists, two computed "true" values are shown, as indicated above.

A "good" or "high" response rate for a characteristic means that an estimate of the population proportion based only on the material contained in the Cycle Survey would be an overestimate. Conversely, a "poor" or "low" response rate would result in an underestimate.

(a) ***Removals*** – removals have a low response rate. The cycle value is 19.4 per cent while the true value is 19.9 per cent or 21.5 per cent.

(b) ***Normal*** – all of the following results refer to the number of persons possessing a characteristic as a percentage of all those other than the removals who received the questionnaire.

These results were based on the 1958–59 data and so those not practicing their profession were included in the removal group. In later cycles the "not practicing" are included in the normal group so that the figures given here are not on a basis completely comparable with later Cycle Surveys.

1. ***Field of Undergraduate Study***

   Scientists (includes: Bacteriology, Biology, General Science, Geoscience, Mathematics, Mathematics and Physics, Physiology and Biochemistry, Physics, Physics and Chemistry) have a high response rate.

   The cycle value is 19.8 per cent while the true value is 19.2 per cent or 16.5 per cent.

   Engineers, Architects, and Agriculturists display no significant bias.

2. ***Employment Status***

   Those working ***full time for themselves*** are poor responders. Cycle value is 8.7 while true value is 8.6 or 11.2.

   Working ***full-time for employers*** have a high response rate. Cycle value is 89.9 while true value is 87.7 or 86.4. ***Part-time workers*** are few in number and show no significant difference.

3. ***Marital Status***

   No significant difference.

4. ***Year of Bachelor Graduation and Year of Birth***

   Both by year of bachelor graduation and by age, older persons (born before 1918, or graduated before 1941) seem to be slightly better respondents, but the difference is not significant. Therefore, no "true" values have been calculated.

5. ***Proportion with Master's and Doctor's Degrees***

   Persons with Master's and Doctor's degrees seem to be slightly better respondents than others. The difference is just significant.

   The cycle value is 14.7 per cent while the true value is 14.2 per cent or 13.1 per cent.

6. ***Proportion Failing to Answer Question on Association Membership***

   The proportion who do not answer this question rises significantly from the Cycle to the A's and again to the registers. While it is tempting to assume that those who did not answer the question do not belong to any association, the assumption is somewhat tenuous. We do not, after all, assume that those who do not answer the income question have no income.

   The cycle value is 13.9 per cent while the true value is 15.1 per cent or 17.1 per cent.

7. ***Income***

   Before this variate was tested for bias, those working only part-time or less than 10 months were excluded.

Those reporting incomes under $7,000 per year seem to be poorer respondents than those reporting higher incomes.

The cycle percentage with income under $7,000 per year is 39.3 per cent while the true value is 39.8 per cent or 41.1 per cent.

8. *Function*

There is no significant bias in the groups usually referred to as "Production, Operation, Maintenance", "Administrative, Managerial, Executive", "Supervision", or "Teaching, etc.".

The group "Sales, Service, Marketing" has a lower response rate.

The cycle value is 7.1 per cent while the true value is 7.5 per cent or 7.8 per cent.

9. *Type of Employer*

Those working in *Industry* display no significant bias.
Those in "Business Service" have a lower response rate.

The cycle value is 9.9 per cent while the true value is 10.6 per cent or 12.6 per cent.

Those in "Governments" have a high rate of response.
The cycle proportion is 20.1 per cent while the true value is 19.6 per cent or 18.8 per cent.

10. *Province of Employment*

The only provinces which display significant non-response biases are Quebec and Ontario.

Ontario residents have a high response rate while Quebec residents have a low response rate.

The percentage of Ontario residents in the cycle is 46.0 per cent while the true value is 45.1 per cent or 42.0 per cent.

The percentage of Quebec residents in the cycle is 23.1 per cent while the true value is 23.8 per cent or 25.4 per cent.

11. *Country of Birth*

There is no significant difference between Canadian and foreign born scientific and technical personnel in regard to response.

INCOME NON-RESPONSE INVESTIGATION

Introduction

Of the 13,912 cards representing all those other than the "removals" in the Cycle Survey, 529 (3.8 per cent) failed to respond to the income query. Of this group, 66 (12 per cent) worked part-time, less than 10 months, or failed to state the number of months worked. The remainder, 463 persons who worked full-time but failed to reply to the income questions are the basis of the figures given below.

A word on interpretation is perhaps in order. Of the normal cycle respondents, 463 (3.3 per cent) were working full-time but failed to answer the income question. As can be seen from the tables below, 8.4 per cent of the architects who returned questionnaires in the cycle failed to answer the income question, while only 2.0 per cent of the scientists working full time failed to do so. The weighted average of all fields of study would, of course, be 3.3 per cent. Thus any group of which more 3.3 per cent did not answer the income question can be said to have a lower than average response rate on this question, while a group of which less than 3.3 per cent failed to reply to the income question can be said to have a higher than average response rate. Thus the architects who return the cycle questionnaire have a low response rate in regard to the income question and the scientists have a high rate.

It is important to remember that the results in this section refer to the income question response rates of those who returned questionnaires before the cut-off date for the Cycle Survey and were not removals. The fact that architects for example, are shown here to have a low response rate in the sense used above does **not necessarily** mean that a lower than average percentage of them return the cycle questionnaire however suggestive it may be.

Summary of Results

The group with the lowest response rate was that of the full-time self-employed, 15.2 per cent of whom failed to answer the income question. Architects, older persons, and those engaged in business service also had low response rates. These characteristics are probably highly intercorrelated.

Results

The figures show the percentage of each cycle group who returned a cycle questionnaire, were not removals, and were employed full-time but did not answer the income question.

1. ***Overall Percentage***

$$\frac{463}{13{,}912} \times 100\% = \quad 3.3\%$$

2. ***Field of Undergraduate Study***

Architecture	8.4
Agriculture	4.5
Engineering	3.2
Science	2.0

3. ***Employment Status***

Working full-time for employer	2.2
Working full-time for self	15.7

4. ***Marital Status***

Married	3.3

5. *Year of Bachelor Graduation*

1941 or earlier	4.8
1942–44	3.3
1953 or later	1.8

6. *Educational Level*

Master's and Doctor's	2.6

7. *Year of Birth*

Before 1895	8.7
1895–1898	5.8
1899–1903	5.9
1904–1908	4.0
1909–1913	3.9
1914–1918	3.8
1919–1923	2.9
1924–1928	2.7
1929–1933	1.9
1934–1938	0.7

8. *Function*

Production, Operation, Maintenance	5.0
Sales, Service, Marketing, Puchasing	3.9
Administrative, Managerial, Executive	3.5
Teaching, Instruction, Extension Work	2.3
Supervision	1.8

9. *Type of Employer*

Business Service	7.4
Industry	3.5
Governments	0.9

10. *Province of Employment*

Manitoba, Saskatchewan	4.6
Quebec	3.9
Ontario	3.2
British Columbia	3.0
Maritimes	2.3
Alberta	2.2

Conclusions

One of the most interesting results is that even in cases where the non-response bias is fairly strong (e.g., in the provincial distribution), it does not greatly affect the results obtained. **This is due to the high rate of response obtained in the Cycle Survey.** If the rate of response could be raised even more, the non-response biases would affect the results even less.

It should be noted that the fact that a characteristic displays no **significant** non-response bias does not mean that no bias exists. It is,

however, probable that any such bias would be weaker than those which are significant and so would affect the results even less.

The section on income non-respondents, for instance, suggests (but certainly does not prove) that some characteristics which displayed no significant bias in the main investigation may, in fact, be slightly biased. This condition obtains in regard to a number of characteristics, the percentage of architects in the total being an outstanding example.

These results are based, as previously noted, on Cycle III data. Caution must be used in applying them to other Cycles for a number of reasons. Persons not practicing[1] are in the "removals" group whereas in the more recent Cycle I they are not segregated from the normal group. Definitions and classifications have also changed from cycle to cycle.

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[1] It is impossible to determine the effect of this change. Punched cards for the not practicing group are not available for the Cycle III Survey. They are available for the Cycle I Survey, but the definition and coding procedures have so changed that no meaningful conclusions about the effects of their inclusion in the "normal" group can be drawn.

*It may be noted that non-response in row (h), Table 1, page 4 is expressed slightly differently, as a percentage of total questionnaires mailed.

APPENDIX IV

Numerical Reconciliation of Table Totals

This Appendix is included in tabular form in order to provide for ready reference a list of the groups of persons in the survey who may not have been included in the 27 Appendix Tables based on particular tabulations. The table numbers are given on the left side of the tables, and each row is arranged to cover those excluded from the particular table. On the right-hand side of the table, the three final columns relate to the total number excluded from the particular table, plus those included, giving the total covered in the survey.

The exclusions from the various tables may occur for a number of reasons, as indicated in the Reconciliation Table. In many cases, the arrangement of the data required that certain groups be removed. For example, in tables dealing with earnings, those who worked part-time or less than ten months were excluded, as well as students, those who were retired, housewives and so on. In other cases, the tabulations on which particular tables were based were restricted to certain groups, such as engineers and scientists for example. In still other cases, variations between the groups excluded or included in the tables may occur because some respondents may or may not have answered certain questions.

Numerical Reconciliation of Table Totals

TABLE NUMBER	GROUPS EXCLUDED FROM TABLES														Total Included in Table	Total in Survey
							Information Not Given									
	Not Employed in Canada[1]	Students, Retired, Housewives	Employed Less than 10 Months, Part-Time, or Unemployed	Studied Architecture, Engineering of Veterinary Medicine	Non-Graduates[2]	Others Excluded from Survey Analysis[3]	Country of Birth or Place of Employment	Year of Bachelor Graduation	Function	Industry	Employment Status or Number of Months Worked	Earnings or Other Income	Field of Employment Specialization	Total Excluded from Table		
A– 1	964	766	623	813	877	401	–	26	–	–	–	213	–	4,683	12,308	
A– 2	877	255	536	902	538	541[6]	–	11	–	–	–	189	2,337	6,186	10,805	
A– 3*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
A– 4	964	766	575	813	401	401	–	–	–	–	1	351	–	4,272	12,719	
A– 5	964	302	570	813	401	401	570	144	84	–	287	214	–	4,750	12,241	
A– 6	986	801	649	–	401	401	–	–	–	–	316	260	–	3,814	13,177	
A– 7	986	802	618	–	401	382[5]	–	–	–	–	–	393	–	3,582	13,409	
A– 8 and A– 9	964	766	575	813	401	401	–	–	–	–	1	351	–	4,272	12,719	
A–10	964	766	575	8,972	401	401	–	–	–	–	1	351	–	12,431	4,560	16,991
A–11	986	801	649	–	401	401	–	–	–	–	8	348	–	3,594	13,397	
A–12	986	801	600	–	401	401	–	–	–	158	–	349	–	3,696	13,295	
A–13	964	766	558	813	401	401	–	–	–	144	–	313	–	4,360	12,631	
A–14	986	801	649	1,480[4]	401	401	–	–	–	–	8	348	–	5,074	11,917	
B– 1 and B– 2	964	766	–	813	401	401	–	–	–	157	–	–	1,683	5,185	11,806	
B– 3 and B– 4	964	766	–	813	401	401	–	–	101	157	–	–	–	3,603	13,388	
B– 5 and B– 6	964	766	–	813	420	401	–	161	139	–	–	–	–	3,664	13,327	
B– 7	986	806	49	858	401	531[7]	–	–	81	–	–	–	1,750	5,462	11,529	
B– 8 and C– 1	986	806	49	–	401	382[5]	–	–	–	–	–	–	–	2,624	14,367	
C– 2	964	766	–	813	401	401	103	161	–	–	–	–	–	3,610	13,381	
C– 3 and C– 4	986	806	49	858	401	531[7]	–	–	–	–	–	–	1,750	5,381	11,610	
D– 1	964	766	–	813	419	401	463	161	–	–	–	–	–	3,987	13,004	

*Table A–3 was not balanced since it included data from other surveys.

[1] Includes 287 non-Canadians not working in Canada.

[2] 401 did not attend university; the remainder attended but did not graduate.

[3] Includes 401 in the following categories: 170 deceased; 182 who were non-engineering or non-scientific personnel; 17 who gave insufficient information or refused to supply information; 13 who graduated in 1959; and 19 who studied non-engineering or non-scientific courses.

[4] Self-employed and 221 in science.

[5] Excludes 19 who studied non-engineering or non-scientific courses.

[6] Includes 159 in other scientific and technical fields; excludes 19 who studied non-engireering or non-scientific courses.

[7] Includes 149 in other scientific and technical fields; excludes 19 who studied non-engineering or non-scientific courses.

APPENDIX TABLES

Table A–1 – Median Earnings in Engineering and Science by Years from Bachelor Graduation and Level of Education, 1959

Years from Bachelor Graduation	Total		Engineering – Level of Education[1]						Science – Level of Education[1]					
			Total		Bachelor's		Master's or Doctor's		Total		Bachelor's		Master's or Doctor's	
	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$
Over 40	125	10,400	93	10,650	84	10,850	9	—	32	8,950	17	8,200	15	10,200
36 – 40	345	10,350	223	11,500	192	11,550	31	11,300	122	8,500	64	7,800	58	9,100
31 – 35	552	10,700	354	11,900	307	11,900	47	12,100	198	8,900	106	8,350	92	9,650
26 – 30	791	10,050	471	10,600	396	10,500	75	10,850	320	9,000	164	8,250	156	9,900
21 – 25	1,121	9,800	689	10,600	611	10,550	78	10,950	432	8,400	248	7,950	184	8,900
16 – 20	1,267	9,450	762	10,150	689	10,100	73	10,250	505	8,350	293	7,700	212	9,050
11 – 15	1,887	8,600	1,203	9,100	1,058	9,100	145	9,300	684	7,650	407	7,350	277	8,050
6 – 10	3,910	7,500	2,492	7,850	2,291	7,850	201	7,900	1,418	6,650	993	6,550	425	6,950
1 – 5	2,310	5,700	1,622	5,950	1,521	5,900	101	6,500	688	5,350	596	5,250	92	5,750
5	379	6,550	235	6,850	207	6,850	28	6,950	144	5,850	100	5,750	44	6,050
4	422	6,350	288	6,550	255	6,550	33	6,550	134	5,600	110	5,550	24	5,800
3	493	6,000	347	6,200	317	6,200	30	6,050	146	5,500	130	5,450	16	5,600
2	513	5,550	367	5,650	358	5,700	9	—	146	4,900	138	4,900	8	—
1	503	5,450	385	5,400	384	5,400	1	—	118	4,550	118	4,550	—	—
Total	12,308[2]	7,800	7,909	8,250	7,149	8,200	760	8,800	4,399	7,100	2,888	6,650	1,511	7,900

[1]See Appendix 2 for explanation of level of education groupings.
[2]See Appendix 4 for groups excluded.

Table A–2 – Median Earnings of Those Employed in Engineering and Science by Years from Bachelor Graduation and Level of Education, 1959

Years from Bachelor Graduation	Engineering – Level of Education[1]					Science – Level of Education[1]				
	Total	Bachelor's		Master's or Doctor's		Total	Bachelor's		Master's or Doctor's	
	Number	Number	$	Number	$	Number	Number	$	Number	$
Over 40	69	60	10,650	9	–	37	23	8,050	14	9,950
36 – 40	157	141	10,600	16	11,200	118	63	8,000	55	9,650
31 – 35	277	241	11,500	36	12,300	193	107	8,250	86	9,500
26 – 30	383	323	10,350	60	11,100	287	144	8,400	143	9,900
21 – 25	542	489	10,300	53	11,250	417	229	7,750	188	8,950
16 – 20	640	580	10,050	60	10,000	485	276	7,700	209	9,000
11 – 15	1,000	889	8,950	111	9,450	632	351	7,500	281	7,950
6 – 10	2,161	1,997	7,800	164	7,900	1,298	878	6,700	420	7,050
1 – 5	1,438	1,356	5,900	82	6,400	671	574	5,350	97	5,750
5	210	185	6,800	25	6,800	135	94	6,000	41	6,000
4	261	232	6,550	29	6,450	114	90	5,600	24	5,800
3	300	278	6,150	22	6,250	153	131	5,600	22	5,700
2	332	327	5,700	5	–	136	126	5,100	10	5,450
1	335	334	5,400	1	–	133	133	4,750	–	–
Totals	6,667[2]	6,076	8,150	591	8,750	4,138[2]	2,645	6,750	1,493	7,900

[1] See Appendix 2 for explanation of level of education groupings.
[2] See Appendix 4 for groups excluded.

Table A–3 – A Comparison of Median Earnings of Those Employed in Engineering and Science by Years from Bachelor Graduation and Level of Education, 1957, 1958 and 1959

Years from Bachelor Graduation	Engineering – Level of Education[1]						Science – Level of Education[1]					
	Bachelor's			Master's or Doctor's			Bachelor's			Master's or Doctor's		
	1957 Survey	1958 Survey	1959 Survey	1957 Survey	1958 Survey	1959 Survey	1957 Survey	1958 Survey	1959 Survey	1957 Survey	1958 Survey	1959 Survey
	$	$	$	$	$	$	$	$	$	$	$	$
Over 40	9,600[2]	8,700	10,650	9,700[2]	[3]	[3]	7,400[2]	7,150	8,050	8,800[2]	10,300	9,950
36 – 40		11,000	10,600		15,200	11,200		7,750	8,000		9,600	9,650
31 – 35	10,750	10,650	11,500	9,300	10,300	12,300	8,250	7,850	8,250	8,800	9,300	9,500
26 – 30	9,900	10,150	10,350	8,950	10,650	11,100	7,200	7,900	8,400	8,550	8,800	9,900
21 – 25	10,150	9,950	10,300	9,050	10,250	11,250	7,600	7,600	7,750	8,050	8,550	8,950
16 – 20	9,500	9,800	10,050	9,650	9,300	10,000	7,300	7,800	7,700	7,950	8,300	9,000
11 – 15	8,650	8,850	8,950	8,600	9,000	9,450	6,800	7,050	7,500	7,450	7,650	7,950
6 – 10	7,450	7,650	7,800	7,600	7,850	7,900	6,200	6,350	6,700	6,300	6,700	7,050
1 – 5	5,700	5,850	5,900	5,950	6,050	6,400	4,900	5,300	5,350	5,100	5,750	5,750
5	6,500	6,650	6,800	6,800	6,500	6,800	5,700	5,550	6,000	5,400	6,150	6,000
4	6,300	6,400	6,550	5,700	5,900	6,450	5,300	5,700	5,600	5,800	6,200	5,800
3	[4]	5,950	6,150	[4]	5,800	6,250	[4]	5,250	5,600	[4]	5,450	5,700
2	5,600	5,600	5,700	[3]	[3]	[3]	4,700	5,100	5,100	4,200	[3]	5,450
1	5,200	5,350	5,400	[3]	[3]	[3]	4,600	5,050	4,750	[3]	[3]	—
Total	7,800	7,850	8,150	8,250	8,650	8,750	6,300	6,500	6,750	7,200	7,650	7,900

[1] See Appendix 2 for explanation of level of education groupings.
[2] Over 36 years from bachelor graduation.
[3] Medians for less than 10 not computed.
[4] Graduates of 1954 not included in the 1957 survey.

Table A–4 – Median Earnings in Engineering and Science by Industry and Years from Bachelor Graduation, 1959

INDUSTRY[1]	Total		YEARS FROM GRADUATION											
			Over 40		31 – 40		21 – 30		11 – 20		1 – 10		Not Stated	
	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$
Engineering														
Private Industry	5,727	8,550	51	12,450	431	12,350	829	11,400	1,457	9,650	2,879	7,300	80	9,850
Professional Service	811	8,750	25	12,200	48	15,050	106	12,050	213	10,200	412	7,450	7	–
Universities	153	7,850	2	–	17	12,050	27	10,000	44	8,800	62	6,300	1	–
Governments	1,354	7,300	18	7,350	83	9,200	201	8,850	265	8,200	770	6,600	17	7,050
High Schools	57	7,100	–	–	15	9,100	12	8,700	8	–	21	6,150	1	–
Not Stated	57	9,450	1	–	3	–	6	–	21	10,550	24	7,950	2	–
Total, Engineering	8,159	8,250	97	10,500	597	11,650	1,181	10,600	2,008	9,450	4,168	7,150	108	9,250
Science														
Private Industry	1,911	7,400	8	–	91	10,450	264	10,500	519	8,600	1,010	6,500	19	9,700
Professional Service	185	8,400	2	–	10	8,950	30	11,950	67	9,000	74	7,000	2	–
Universities	404	8,250	5	–	54	9,700	89	9,700	132	8,800	123	6,300	1	–
Governments	1,525	6,550	15	6,200	123	8,050	275	7,450	382	7,450	719	5,950	11	6,800
High Schools	499	7,050	2	–	45	8,700	106	8,750	113	7,400	231	5,900	2	–
Not Stated	36	6,800	2	–	3	–	5	–	10	10,300	16	6,150	–	–
Total, Science	4,560	7,050	34	8,950	326	8,750	769	8,700	1,223	7,900	2,173	6,200	35	8,800
Total, Engineering and Science	12,719[2]	7,800	131	10,250	923	10,500	1,950	9,900	3,231	8,850	6,341	6,800	143	9,050

[1]See Appendix 2 for explanation of industry groups.
[2]See Appendix 4 for groups excluded.

Table A–5 – Median Earnings in Engineering and Science by Years from Bachelor Graduation and Function, 1959

YEARS FROM BACHELOR GRADUATION	Total	FUNCTION																			
		Construction, Installation, Erection		Design		Executive, Administrative		Field Exploration		Production, Operation, Maintenance		Research, Development		Sales, Service, Marketing, Purchasing		Teaching, Instructing, Extension Work		Testing, Inspection, Laboratory Services		Other (Incl. medical diagnosis and treatment)	
	Number	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$
Engineering																					
Over 40	93	13	8,450	12	6,600	45	15,400	1	–	5	–	2	–	5	–	3	–	1	–	6	–
31 – 40	573	35	10,550	49	8,550	307	14,650	11	11,700	41	9,900	27	9,450	33	10,450	28	9,450	10	6,950	32	9,600
21 – 30	1,155	76	9,500	116	8,850	576	13,050	13	9,200	105	9,800	67	9,650	76	8,950	34	8,950	44	7,850	48	9,400
11 – 20	1,952	177	9,000	279	8,600	704	10,800	27	8,550	251	9,000	141	8,950	196	9,000	52	8,300	49	8,250	76	8,850
1 – 10	4,087	584	6,950	719	6,950	651	8,250	100	7,100	799	7,150	322	6,700	429	7,400	89	6,150	120	6,600	274	6,850
Total, Engineering	7,860[1]	885	7,500	1,175	7,500	2,283	10,700	152	7,600	1,201	7,700	559	7,650	739	8,050	206	7,400	224	7,150	436	7,500
Science				–	–																
Over 40	32	–	–	–	–	13	12,200	–	–	–	–	6	–	1	–	9	–	1	–	2	–
31 – 40	319	–	–	3	–	106	11,100	4	–	18	6,950	59	8,300	12	7,300	95	8,550	10	6,600	12	6,950
21 – 30	748	5	–	3	–	229	10,850	15	10,700	53	7,750	149	7,850	30	7,950	186	8,600	37	6,600	41	7,350
11 – 20	1,185	11	7,700	18	7,200	240	9,650	40	9,950	95	8,000	306	8,050	81	7,650	254	7,600	79	6,350	61	7,000
1 – 10	2,097	25	6,250	30	6,400	228	7,050	144	6,600	180	6,250	500	6,400	191	6,450	413	5,950	180	5,250	206	5,650
Total, Science	4,381[1]	41	6,600	54	6,600	816	9,150	203	6,950	346	6,800	1,020	7,150	315	6,850	957	7,000	307	5,650	322	6,050

[1] See Appendix 4 for groups excluded.

Table A–6 – Median Earnings in Engineering and Scientific Specializations by Undergraduate Course and Years from Bachelor Graduation, 1959

UNDERGRADUATE COURSE	Total		YEARS FROM BACHELOR GRADUATION											
			Over 40		31 – 40		21 – 30		11 – 20		1 – 10		Not Stated	
	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$
Engineering – Total	8,052	8,250	95	10,550	581	11,700	1,164	10,600	1,976	9,300	4,129	7,150	107	9,050
Aeronautical	58	7,950	–	–	1	–	5	–	14	9,950	37	7,500	1	–
Chemical	1,070	8,250	4	–	73	11,700	170	11,650	295	9,500	523	7,050	5	–
Civil	2,094	8,100	52	10,200	151	11,850	265	10,150	450	9,550	1,155	7,150	21	8,100
Electrical	1,685	8,450	10	15,950	162	11,650	292	10,400	400	9,250	792	7,200	29	9,450
Engineering Physics	185	7,950	–	–	1	–	2	–	56	9,700	125	7,400	1	–
Forest	124	7,200	3	–	12	10,450	21	7,850	24	7,150	64	6,700	–	–
Geological	129	8,350	1	–	2	–	8	–	34	8,850	84	7,750	–	–
Mechanical	1,680	8,200	13	13,450	105	10,850	208	11,200	430	9,600	897	7,050	27	8,700
Metallurgical	219	8,600	1	–	16	11,600	40	10,950	69	9,750	91	7,250	2	–
Mining	477	9,350	5	–	48	13,950	137	10,550	139	9,500	137	7,450	11	11,450
Petroleum	47	7,600	–	–	2	–	1	–	6	–	37	7,000	1	–
Other	284	7,600	6	–	8	–	15	9,200	59	9,150	187	7,100	9	–
Science – Total	2,583	7,600	15	10,700	170	9,700	486	9,400	737	8,350	1,148	6,400	27	9,450
Biology	209	7,250	–	–	18	9,450	48	8,550	62	7,650	81	5,950	–	–
Chemistry	670	8,150	4	–	55	9,650	157	10,100	231	8,600	213	6,850	10	8,450
General Science	689	6,450	3	–	30	10,150	65	8,550	150	7,500	431	5,750	10	11,950
Geology	250	8,450	–	–	15	10,200	45	11,450	59	9,650	130	7,150	1	–
Mathematics	107	8,000	1	–	6	–	25	9,450	33	8,550	41	6,550	1	–
Mathematics and Physics	266	8,300	2	–	18	10,450	64	9,450	86	8,900	95	7,050	1	–
Physics	146	7,750	3	–	9	–	24	8,600	41	8,400	66	6,950	3	–
Other Science	246	8,150	2	–	19	8,800	58	9,400	75	8,850	91	6,600	1	–
Agriculture	1,448	6,450	14	5,950	127	7,600	228	7,150	380	6.950	695	5,900	4	–
Architecture	337	8,850	4	–	21	13,450	65	11,850	58	10,950	182	7,150	7	–
Forestry	426	6,750	5	–	26	10,450	41	10,050	77	8,200	273	6,300	4	–
Veterinary Medicine	331	7,350	6	–	18	6,950	41	7,500	91	7,500	175	7,200	–	–
Total, All Courses	13,177[1]	–	139	–	943	–	2,025	–	3,319	–	6,602	–	149	–

[1]See Appendix 4 for groups excluded.

Table A-7 – Median Earnings of Those Employed in Engineering and Scientific Professions, 1959

Fields of Employment Specialization	Total	Median Earnings
	Number	$
Engineering		
Aeronautical	165	8,050
Chemical	360	7,850
Civil	1,970	7,900
Electrical	1,643	8,150
Mechanical	1,619	8,000
Metallurgical	323	9,050
Mining	316	9,350
Petroleum	391	8,750
Total, Engineering	6,787	8,150
Science		
Biology	325	7,000
Chemistry	1,221	7,750
Geography	42	6,650
Geosciences	441	8,150
Mathematics	203	7,850
Physics and Engineering Physics	343	7,550
Total, Science	2,575	7,650
Agriculture	1,124	6,400
Architecture	457	8,700
Forestry	460	6,900
Veterinary Medicine	324	7,350
Other Scientific and Technical Fields	140	8,200
Not Stated	1,542	8,350
Total All Specializations	13,409[1]	7,800

[1]See Appendix 4 for groups excluded.

Table A–8 – Median Earnings in Engineering and Science by Place of Employment and Years from Bachelor Graduation, 1959

PLACE OF EMPLOYMENT	Total		YEARS FROM BACHELOR GRADUATION											
			Over 40		31 – 40		21 – 30		11 – 20		1 – 10		Not Stated	
	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$
Engineering														
Atlantic	375	7,450	6	–	22	10,100	54	9,600	79	8,500	208	6,550	6	–
Quebec	2,135	8,500	31	10,550	198	12,950	327	11,100	545	9,750	1,017	7,000	17	10,700
Ontario	3,830	8,350	46	10,950	291	11,150	589	10,600	946	9,400	1,899	7,250	59	8,250
Prairies	1,085	7,900	9	–	39	11,200	97	10,550	246	9,450	685	7,200	9	–
Pacific	705	8,250	5	–	45	11,050	111	10,200	181	8,950	348	7,300	15	9,300
Not Stated	29	8,850	–	–	2	–	3	–	11	10,200	11	8,100	2	–
Total, Engineering	8,159	8,250	97	10,500	597	11,650	1,181	10,600	2,008	9,450	4,168	7,150	108	9,100
Science														
Atlantic	298	6,200	2	–	17	7,450	43	7,650	82	6,900	152	5,400	2	–
Quebec	886	6,950	10	5,700	65	7,750	158	8,050	266	7,950	382	6,150	5	–
Ontario	1,938	7,550	16	9,950	161	9,400	380	9,200	499	8,300	866	6,450	16	8,950
Prairies	923	6,800	3	–	56	7,850	121	8,300	225	7,500	510	6,200	8	–
Pacific	496	6,650	1	–	25	8,650	64	7,900	146	7,500	256	6,050	4	–
Not Stated	19	7,450	2	–	2	–	3	–	5	–	7	–	–	–
Total, Science	4,560	7,100	34	8,950	326	8,750	769	8,700	1,223	7,900	2,173	6,200	35	8,800
Total, Engineering and Science	12,719[1]	7,800	131	10,250	923	10,500	1,950	9,900	3,231	8,850	6,341	6,800	143	9,050

[1]See Appendix 4 for groups excluded.

Table A–9 – Median Earnings in Engineering and Science by Location of Undergraduate University, Place of Birth, and Years from Bachelor Graduation, 1959

LOCATION OF UNDERGRADUATE UNIVERSITY AND PLACE OF BIRTH	Total		YEARS FROM BACHELOR GRADUATION											
			Over 40		31–40		21–30		11–20		1–10		Not Stated	
	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$
Engineering														
Canadian Universities														
Canadian Born	6,516	8,300	73	10,550	395	11,550	904	10,800	1,663	9,500	3,443	7,200	38	9,950
Foreign Born	655	8,350	3	–	76	11,550	114	11,050	148	9,450	309	7,850	5	–
Not Stated	316	6,650	1	–	3	–	8	–	16	8,450	288	6,550	–	–
Total, Canadian Universities	7,487	8,200	77	10,700	474	11,550	1,026	10,800	1,827	9,450	4,040	7,150	43	9,800
Foreign Universities														
Canadian Born	142	9,700	1	–	17	13,450	34	11,950	51	9,650	33	6,550	6	–
Foreign Born	517	8,700	19	7,450	105	12,000	120	8,500	128	8,650	89	7,500	56	8,950
Not Stated	13	5,550	–	–	1	–	1	–	2	–	6	–	3	–
Total, Foreign Universities	672	8,900	20	7,950	123	12,150	155	9,300	181	8,950	128	7,250	65	8,800
Total, Engineering	8,159[1]	8,250	97	–	597	–	1,181	–	2,008	–	4,168	–	108	–
Science														
Canadian Universities														
Canadian Born	3,835	7,000	23	7,000	226	8,650	653	8,600	1,029	7,850	1,887	6,200	17	8,450
Foreign Born	399	7,500	4	–	55	9,450	70	9,500	102	8,100	160	6,150	8	–
Not Stated	84	6,250	–	–	–	–	4	–	12	7,450	68	6,000	–	–
Total, Canadian Universities	4,318	7,050	27	7,700	281	8,800	727	8,650	1,143	7,850	2,115	6,200	25	9,300
Foreign Universities														
Canadian Born	39	7,800	1	–	4	–	5	–	13	8,700	15	6,050	1	–
Foreign Born	199	7,950	6	–	41	7,850	37	9,100	66	8,350	40	6,700	9	–
Not Stated	4	–	–	–	–	–	–	–	1	–	3	–	–	–
Total, Foreign Universities	242	7,900	7	–	45	8,050	42	9,450	80	8,400	58	6,500	10	7,950
Total, Science	4,560[1]	7,100	34	–	326	–	769	–	1,223	–	2,173	–	35	–

[1]See Appendix 4 for groups excluded.

Table A–10 – Median Earnings in Science by Level of Education, Sex, and Years from Bachelor Graduation, 1959

LEVEL OF EDUCATION AND SEX	Total		YEARS FROM BACHELOR GRADUATION											
			Over 40		31–40		21–30		11–20		1–10		Not Stated	
	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$
Non-Graduates														
Males	36	8,200	–	–	–	–	–	–	–	–	–	–	36	8,200
Females	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bachelor's Degrees														
Males	2,857	6,700	18	7,450	171	8,150	413	8,200	702	7,550	1,550	6,100	3	–
Females	140	4,350	–	–	3	–	13	6,700	26	4,650	98	4,050	–	–
Master's Degrees														
Males	744	7,400	5	–	65	8,500	178	8,400	210	7,850	286	6,500	–	–
Females	25	5,500	–	–	3	–	4	–	8	–	10	4,600	–	–
Doctor's Degrees														
Males	734	8,600	11	10,450	79	10,000	158	10,250	269	8,800	216	7,200	1	–
Females	24	7,050	–	–	4	–	3	–	7	–	10	5,950	–	–
Total, Science														
Males	4,371	7,150	34	8,950	315	8,700	749	8,750	1,181	7,950	2,052	6,300	40	8,200
Females	189	4,700	–	–	10	8,600	20	6,950	41	5,200	118	4,200	–	–
All Levels, Males and Females	4,560[1]	7,100	34	8,950	325	8,750	769	8,700	1,222	7,900	2,170	6,200	40	8,200

[1]See Appendix 4 for groups excluded.

Table A–11 – Median Earnings by Industry of the Self-Employed Compared to Those Working for an Employer, Engineering, Science, Architecture, Veterinary Medecine, 1959

INDUSTRY[1]	Total	ENGINEERING				SCIENCE				ARCHITECTURE				VETERINARY MEDICINE			
		Self-Employed		Working for an Employer		Self-Employed		Working for an Employer		Self-Employed		Working for an Employer		Self-Employed		Working for an Employer	
	Number	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$	Number	$
Private Industry	7,822	253	10,800	5,470	8,450	161	6,800	1,749	7,400	3	–	32	8,700	132	8,250	22	8,300
Professional Service	1,272	293	12,000	517	7,850	46	12,300	139	7,900	178	12,400	89	6,350	6	–	4	–
Universities	579	–	–	153	7,850	1	–	403	8,250	–	–	8	–	–	–	14	8,450
Governments	3,068	3	–	1,351	7,300	–	–	1,524	6,550	–	–	30	8,200	3	–	157	6,950
High Schools	556	–	–	57	7,100	1	–	498	7,050	–	–	–	–	–	–	–	–
Not Stated	100	24	10,200	32	8,350	12	6,950	24	6,750	2	–	2	–	3	–	1	–
Total, All Industries	13,397[2]	573	10,900	7,580	8,150	221	7,800	4,337	7,050	183	12,250	161	7,150	144	8,200	198	7,050

[1]See Appendix 2 for explanation of industry groups.
[2]See Appendix 4 for groups excluded.

Table A–12 – Industry by Type of Professional Income, Engineering, Science, Architecture, Veterinary Medicine, 1959

Industry[1]	Total	Engineering		Science		Architecture		Veterinary Medicine	
		Earnings Only	Earnings and Other Professional Income	Earnings Only	Earnings and Other Professional Income	Earnings Only	Earnings and Other Professional Income	Earnings Only	Earnings and Other Professional Income
	Number	Number	Number	Number	Number	Number	Number	Number	Number
Private Industry	8,131	5,800	176	1,889	82	31	4	137	12
Governments	2,760	1,040	70	1,394	71	25	5	143	12
Professional Service	1,271	771	40	175	10	238	26	11	–
Universities	577	91	62	310	94	3	3	12	2
High Schools	556	46	11	400	99	–	–	–	–
Total, All Employers	13,295[2]	7,748	359	4,168	356	297	38	303	26

[1] See Appendix 2 for explanation of industry groups.
[2] See Appendix 4 for groups excluded.

Table A-13 – Industry by Type of Professional Income and Level of Education, Engineering and Science, 1959

Industry[1]	Total	Earnings Only – Level of Education[2]					Earnings and Other Professional Income – Level of Education[2]				
		Total	No Degree	Bachelor's	Master's	Doctor's	Total	No Degree	Bachelor's	Master's	Doctor's
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Engineering											
Private Industry	5,976	5,800	78	5,325	350	47	176	6	151	16	3
Government	1,110	1,040	13	887	104	36	70	4	54	9	3
Professional Service	811	771	6	671	73	21	40	1	31	7	1
Universities	153	91	1	36	36	18	62	—	21	29	12
High Schools	57	46	1	44	1	—	11	—	11	—	—
Total, Engineering	8,107	7,748	99	6,963	564	122	359	11	268	61	19
Science											
Private Industry	1,971	1,889	19	1,518	223	129	82	2	62	11	7
Government	1,465	1,394	12	777	324	281	71	—	40	14	17
Professional Service	185	175	2	100	32	41	10	—	4	3	3
Universities	404	310	—	47	60	203	94	—	7	20	67
High Schools	499	400	1	333	62	4	99	—	77	18	4
Total, Science	4,524	4,168	34	2,775	701	658	356	2	190	66	98
Total, Engineering and Science	12,631[3]	11,916	133	9,738	1,265	780	715	13	458	127	117

[1]See Appendix 2 for explanation of industry groups.
[2]See Appendix 2 for explanation of level of education.
[3]See Appendix 4 for groups excluded.

Table A–14 – Median Earnings by Level of Other Professional Earnings and Industry, Engineers and Scientists Working for an Employer, 1959

Industry[1]	Total		Median Earnings of Those Whose Other Professional Earnings was Under $950		Median Earnings of Those Whose Other Professional Earnings was $950 or over		Not Stated
	Number	$	Number	$	Number	$	Number
Engineering							
Private Industry	5,470	8,450	91	7,750	64	9,250	5,315
Professional Service	517	7,850	13	8,200	6	—	498
Universities	153	7,850	18	8,200	44	7,850	91
Governments	1,351	7,300	35	7,300	34	7,450	1,282
High Schools	57	7,100	6	—	5	—	46
Not Stated	32	8,350	1	—	1	—	30
Total, Engineering	7,580	8,150	164	7,200	154	8,200	7,262
Science							
Private Industry	1,749	7,400	42	6,800	19	8,550	1,688
Professional Service	139	7,900	5	—	2	—	132
Universities	403	8,250	45	9,400	48	8,550	310
Governments	1,524	6,550	51	6,650	20	6,100	1,453
High Schools	498	7,050	74	7,900	25	7,850	399
Not Stated	24	6,750	1	—	1	—	22
Total, Science	4,337	7,050	218	7,800	115	8,100	4,004
Total, Engineering and Science	11,917[2]	7,700	382	7,500	269	8,250	11,266

[1]See Appendix 2 for explanation of industry groups.
[2]See Appendix 4 for groups excluded.

Table B-1 – Industry by Field of Employment Specialization, Those Who Studied Engineering Courses, 1959

INDUSTRY[1]	Total	FIELD OF EMPLOYMENT SPECIALIZATION: Engineering									Science											
		Total	Aeronautical	Chemical	Civil	Electrical	Mechanical	Metallurgical	Mining	Petroleum	Total	Biology	Chemistry	Geography	Geology	Mathematics	Physics	Agriculture	Architecture	Forestry	Veterinary Medicine	Other Scientific and Technical Fields
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Primary Industries (Except Mining)	34	10	–	–	6	1	3	–	–	–	–	–	–	–	–	–	–	7	–	17	–	–
Mining	513	412	–	8	15	12	18	75	214	70	98	–	7	–	90	1	–	1	–	1	–	1
Manufacturing – Total	2,815	2,401	73	256	177	547	1,009	154	27	158	327	–	294	–	12	2	19	6	17	41	–	23
Foods, Beverages, Tobacco	68	54	1	18	3	6	26	–	–	–	11	–	11	–	–	–	–	1	2	–	–	–
Rubber, Leather, Textiles	104	75	–	16	1	5	52	–	1	–	28	–	28	–	–	–	–	–	1	–	–	–
Wood Products	37	25	–	1	9	1	13	–	1	–	–	–	–	–	–	–	–	–	1	11	–	–
Paper Products	283	202	–	28	21	21	132	–	–	–	46	–	46	–	–	–	–	–	1	30	–	4
Iron and Steel Products	557	539	1	4	81	33	353	59	5	3	11	–	9	–	1	–	1	5	1	–	–	1
Transportation Equipment	213	206	65	1	6	20	102	11	1	–	5	–	2	–	–	–	3	–	1	–	–	1
Non-Ferrous Metal Products	160	153	–	13	7	17	54	58	4	–	5	–	5	–	–	–	–	–	–	–	–	2
Electrical Apparatus	569	546	4	7	4	409	114	8	–	–	16	–	3	–	–	–	13	–	2	–	–	5
Non-Metallic Mineral Products	91	69	–	11	13	5	26	6	8	–	17	–	15	–	1	–	1	–	2	–	–	3
Petroleum and Coal Products	246	217	–	22	18	2	24	2	1	148	27	–	15	–	10	1	1	–	2	–	–	–
Chemical Products	437	269	–	127	13	19	87	10	6	7	157	–	156	–	–	1	–	–	4	–	–	7
All Others	50	46	2	8	1	9	26	–	–	–	4	–	4	–	–	–	–	–	–	–	–	–
Construction	569	531	–	3	391	71	59	–	3	4	5	–	2	–	2	1	–	1	32	–	–	–
Transportation, Storage, Communication	406	396	15	–	93	234	36	1	–	17	2	–	–	–	–	2	–	–	4	–	–	4
Public Utilities	507	492	–	3	73	352	44	–	–	20	6	–	4	–	–	1	1	1	2	2	–	4
Trade, Finance, etc.	464	406	2	20	59	92	141	14	15	63	37	–	30	–	5	–	2	3	9	2	–	7
Professional Service	855	740	2	16	389	100	176	19	27	11	59	–	13	2	23	1	20	1	28	10	–	17
Universities	186	142	2	13	49	30	38	4	5	1	28	–	13	–	4	3	8	9	2	3	–	2
Governments – Total	1,318	1,145	59	13	748	167	105	18	20	15	90	3	29	2	26	2	28	10	16	36	–	21
Federal Government	680	571	59	10	255	130	86	17	10	4	67	2	22	1	15	1	26	6	10	6	–	20
Local Governments	269	263	–	–	230	26	7	–	–	–	2	–	2	–	–	–	–	–	3	1	–	–
Provincial Governments	369	311	–	3	263	11	12	1	10	11	21	1	5	1	11	1	2	4	3	29	–	1
High Schools	36	16	1	1	5	5	4	–	–	–	17	–	6	1	–	7	3	–	1	–	–	2
Other Industries	10	6	–	–	2	2	1	–	–	1	3	1	1	–	1	–	–	–	–	1	–	–
Total All Industries	7,713[2]	6,697	154	333	2,007	1,613	1,634	285	311	360	672	4	399	5	163	20	81	39	111	113	–	81

[1]See Appendix 2 for explanation of industry groups.
[2]See Appendix 4 for groups excluded.

Table B-2 – Industry by Field of Employment Specialization, Those Who Studied Science Courses, 1959

INDUSTRY[1]	Total	FIELD OF EMPLOYMENT SPECIALIZATION																				
		Engineering									Science											
		Total	Aeronautical	Chemical	Civil	Electrical	Mechanical	Metallurgical	Mining	Petroleum	Total	Biology	Chemistry	Geography	Geology	Mathematics	Phycics	Agriculture	Architecture	Forestry	Veterinary Medicine	Other Scientific and Technical Fields
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Primary Industries (Except Mining)	159	–	–	–	–	–	–	–	–	–	2	1	1	–	–	–	–	90	–	67	–	–
Mining	207	44	–	–	1	–	2	9	22	10	162	1	10	–	151	–	1	–	–	–	–	1
Manufacturing – Total	951	170	8	37	3	32	44	25	1	20	552	21	472	1	39	5	14	113	2	103	–	11
Foods, Beverages, Tobacco	187	15	–	7	–	–	8	–	–	–	88	12	76	–	–	–	–	84	–	–	–	–
Rubber, Leather, Textiles	37	4	–	2	–	1	1	–	–	–	33	–	31	1	–	1	–	–	–	–	–	–
Wood Products	39	4	–	–	–	1	3	–	–	–	1	–	1	–	–	–	–	–	1	33	–	–
Paper Products	115	8	–	5	2	–	1	–	–	–	39	–	38	–	–	–	1	–	–	68	–	–
Iron and Steel Products	45	31	–	2	1	2	10	15	1	–	6	1	4	–	–	–	1	5	1	2	–	–
Transportation Equipment	24	11	8	–	–	–	1	2	–	–	11	–	7	–	–	1	3	–	–	–	–	2
Non-Ferrous Metal Products	35	12	–	4	–	–	2	5	–	1	22	–	20	–	1	1	–	–	–	–	–	1
Electrical Apparatus	47	32	–	1	–	26	4	1	–	–	13	–	7	–	–	1	5	–	–	–	–	2
Non-Metallic Mineral Products	16	3	–	1	–	–	2	–	–	–	13	–	11	–	1	–	1	–	–	–	–	–
Petroleum and Coal Products	74	18	–	–	–	–	–	–	–	18	56	–	23	–	33	–	–	–	–	–	–	–
Chemical Products	320	26	–	15	–	–	8	2	–	1	266	8	251	–	4	1	2	23	–	–	–	5
All Others	12	6	–	–	–	2	4	–	–	–	4	–	3	–	–	–	1	1	–	–	–	1
Construction	19	10	–	–	6	1	3	–	–	–	–	–	–	–	–	–	–	2	4	3	–	–
Transportation, Storage, Communication	51	31	–	–	4	23	1	–	–	3	7	–	4	–	–	3	–	9	1	1	–	2
Public Utilities	25	11	–	–	–	8	2	–	–	1	5	–	5	–	–	–	–	7	–	1	–	1
Trade, Finance, etc.	202	27	–	–	3	7	5	1	1	10	87	–	35	–	16	36	–	76	3	7	–	2
Professional Service	180	22	–	2	3	3	3	5	3	3	120	5	49	1	33	6	26	18	4	10	–	6
Universities	439	10	–	3	1	2	1	3	–	–	317	99	80	11	22	50	55	91	–	12	1	8
Governments – Total	1,483	81	11	1	34	18	6	9	2	–	510	129	140	10	67	18	146	696	14	155	4	23
Federal Government	927	59	11	1	16	15	5	9	2	–	409	91	111	10	46	14	137	383	6	49	2	19
Local Governments	23	7	–	–	6	1	–	–	–	–	6	–	5	–	1	–	–	6	3	–	–	1
Provincial Governments	533	15	–	–	12	2	1	–	–	–	95	38	24	–	20	4	9	307	5	106	2	3
High Schools	306	5	–	1	–	2	1	–	–	1	239	50	58	19	1	79	32	48	–	2	–	12
Other Industries	71	–	–	–	–	–	–	–	–	–	64	30	27	–	1	1	5	6	–	–	–	1
Total, All Industries	4,093[2]	411	19	44	55	96	68	52	29	48	2,065	335	881	42	330	198	279	1,156	28	361	5	67

[1]See Appendix 2 for explanation of industry groups.
[2]See Appendix 4 for groups excluded.

Table B-3 – Industry by Function, Engineering, 1959

INDUSTRY[1]	Total All Functions	FUNCTION: Construction, Installation, Erection	Design	Executive, Administrative	Field Exploration	Production, Operation, Maintenance	Research, Development	Sales, Service, Marketing, Purchasing	Teaching, Instructing, Extension Work	Testing, Inspection, Laboratory Service	Others, (Includes Medical Diagnosis, Treatment)
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Primary Industries (Except Mining)	38	2	–	13	5	14	2	1	–	1	–
Mining	538	22	21	147	89	175	33	8	1	6	36
Manufacturing – Total	3,157	173	515	823	14	730	257	426	8	105	106
Foods, Beverages, Tobacco	75	8	7	23	1	27	2	3	1	2	1
Rubber, Leather, Textiles	120	8	12	31	–	36	15	11	–	5	2
Wood Products	50	3	5	17	1	17	1	6	–	–	–
Paper Products	327	35	38	92	4	100	24	4	–	18	12
Iron and Steel Products	635	38	130	179	2	88	29	132	1	20	16
Transportation Equipment	231	2	60	63	–	34	20	25	3	14	10
Non-Ferrous Metal Products	182	7	11	56	–	68	23	5	–	5	7
Electrical Apparatus	608	18	145	152	–	64	45	143	1	16	24
Non-Metallic Mineral Products	111	2	3	37	–	40	11	13	–	4	1
Petroleum and Coal Products	259	30	33	51	5	97	13	11	–	6	13
Chemical Products	491	18	66	101	1	135	72	65	2	13	18
All Others	68	4	5	21	–	24	2	8	–	2	2
Construction	622	274	72	216	2	20	3	15	–	5	15
Transportation, Storage and Communication	449	54	72	181	2	71	24	1	3	4	37
Public Utilities	530	55	106	164	2	121	20	21	–	12	29
Trade, Finance, etc.	624	30	25	158	3	30	9	324	1	9	35
Professional Service	908	117	299	218	33	30	56	24	2	29	100
Universities	189	1	–	10	–	2	13	–	163	–	–
Governments – Total	1,398	226	144	493	33	82	177	2	25	66	150
Federal Government	736	78	48	247	19	46	160	–	15	27	96
Local Governments	284	62	43	128	2	17	5	1	–	5	21
Provincial Governments	378	86	53	118	12	19	12	1	10	34	33
High Schools	67	–	3	9	–	–	–	–	55	–	–
Other Industries	15	1	–	5	–	–	1	1	1	2	4
Total, All Industries	8,535[2]	955	1,257	2,437	183	1,275	595	823	259	239	512

[1]See Appendix 2 for explanation of industry groups.
[2]See Appendix 4 for groups excluded.

Table B-4 – Industry by Function, Science, 1959

INDUSTRY[1]	Total All Functions	FUNCTION: Construction, Installation, Erection	Design	Executive, Administrative	Field Exploration	Production, Operation, Maintenance	Research, Development	Sales, Service, Marketing, Purchasing	Teaching, Instruction, Extension Work	Testing, Inspection, Laboratory Service	Others (Includes Medical Diagnosis, Treatment)
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Primary Industries (except mining)	217	3	1	34	9	115	3	11	–	–	41
Mining	215	1	3	36	93	22	30	1	–	6	23
Manufacturing – Total	1,091	6	26	254	26	191	246	145	8	141	48
Foods, Beverages, Tobacco	214	–	1	53	1	42	33	37	4	41	2
Rubber, Leather, Textiles	45	–	–	16	–	4	16	3	–	4	2
Wood Products	47	1	1	13	3	18	2	5	–	1	3
Paper Products	131	–	1	46	4	38	18	3	–	12	9
Iron and Steel Products	58	3	6	12	–	9	8	12	1	5	2
Transportation Equipment	29	–	3	4	–	2	5	1	1	12	1
Non-Ferrous Metal Products	37	–	–	7	2	5	17	1	–	3	2
Electrical Apparatus	54	2	10	14	–	5	11	5	–	3	4
Non-Metallic Mineral Products	21	–	–	3	–	6	6	1	–	5	–
Petroleum and Coal Products	79	–	–	14	15	14	17	3	–	12	4
Chemical Products	358	–	3	64	1	48	112	71	2	43	14
All Others	18	–	1	8	–	–	1	3	–	–	5
Construction	31	12	1	12	–	1	–	3	1	–	1
Transportation, Storage and Communication	77	6	9	22	–	5	7	6	5	3	14
Public Utilities	33	–	1	8	–	3	3	10	2	3	3
Trade, Finance, etc.	329	5	2	73	12	15	14	158	1	12	37
Professional Service	206	4	7	49	24	6	69	9	4	14	20
Universities	457	–	–	30	–	1	91	1	318	4	12
Governments – Total	1,579	13	11	312	68	41	611	17	202	139	165
Federal Government	987	4	6	171	30	23	525	15	27	89	97
Local Governments	33	1	2	12	–	–	4	–	2	8	4
Provincial Governments	559	8	3	129	38	18	82	2	173	42	64
High Schools	531	–	–	38	–	–	1	–	489	–	3
Other Industries	87	–	1	8	–	–	26	1	6	18	27
Total, All Industries	4,853[2]	50	62	876	232	400	1,101	362	1,036	340	394

[1]See Appendix 2 for explanation of industry groups.
[2]See Appendix 4 for groups excluded.

Table B-5 – Function by Years From Bachelor Graduation and Level of Education, Engineering, 1959

FUNCTION	Total All Years	Over 40				31 – 40				21 – 30				11 – 20				1 – 10			
		Total	Bachelor's	Master's	Doctor's	Total	Bachelor's	Master's	Doctor's	Total	Bachelor's	Master's	Doctor's	Total	Bachelor's	Master's	Doctor's	Total	Bachelor's	Master's	Doctor's
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Construction, Installation, Erection	938	22	22	–	–	40	36	3	1	84	74	8	2	187	179	7	1	605	592	13	–
Design	1,241	16	12	4	–	53	51	2	–	127	102	21	4	294	268	25	1	751	714	35	2
Executive, Administrative	2,411	60	56	3	1	322	288	30	4	604	538	58	8	731	674	53	4	694	640	52	2
Field Exploration	185	4	4	–	–	18	12	3	3	19	13	2	4	32	25	5	2	112	94	11	7
Production, Operation, Maintenance	1,268	6	6	–	–	46	39	5	2	113	104	9	–	269	252	15	2	834	804	29	1
Research, Development	599	2	–	2	–	28	12	11	5	74	53	12	9	147	91	30	26	348	259	62	27
Sales, Service, Marketing, Purchasing	828	9	8	1	–	43	42	1	–	93	87	5	1	219	205	14	–	464	440	24	–
Teaching, Instructing, Extension Work	257	5	4	–	1	35	25	5	5	40	26	10	4	61	26	24	11	116	73	38	5
Testing, Inspection, Laboratory Service	236	3	3	–	–	11	10	–	1	46	42	4	–	52	48	4	–	124	111	13	–
Others (Including Medical Diagnosis, Treatment)	508	17	16	–	1	39	34	3	2	52	44	6	2	86	77	7	2	314	285	29	–
Total	8,471[1]	144	131	10	3	635	549	63	23	1,252	1,083	135	34	2,078	1,845	184	49	4,362	4,012	306	44

[1] See Appendix 4 for groups excluded.

Table B-6 – Function by Years from Bachelor Graduation and Level of Education, Science, 1959

FUNCTION	YEAR FROM BACHELOR GRADUATION AND LEVEL OF EDUCATION																				
		Over 40				31 – 40				21 – 30				11 – 20				1 – 10			
	Total All Years	Total	Bachelor's	Master's	Doctor's	Total	Bachelor's	Master's	Doctor's	Total	Bachelor's	Master's	Doctor's	Total	Bachelor's	Master's	Doctor's	Total	Bachelor's	Master's	Doctor's
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Construction, Installation, Erection	47	–	–	–	–	1	1	–	–	6	5	–	1	11	10	1	–	29	28	1	–
Design	59	–	–	–	–	3	3	–	–	4	4	–	–	18	15	3	–	34	33	1	–
Executive, Administrative	877	17	13	1	3	109	69	20	20	244	146	58	40	252	198	34	20	255	222	30	3
Field Exploration	233	–	–	–	–	7	2	1	4	17	8	3	6	45	20	12	13	164	131	23	10
Production, Operation, Maintenance	402	3	3	–	–	19	14	3	2	62	50	11	1	114	101	11	2	204	189	15	–
Research, Development	1,102	8	1	2	5	67	18	13	36	159	49	48	62	319	68	88	163	549	239	145	165
Sales, Service, Marketing, Purchasing	363	2	2	–	–	12	9	1	2	33	25	7	1	100	88	11	1	216	202	13	1
Teaching, Instructing, Extension Work	1,039	11	4	2	5	107	52	27	28	196	100	44	52	265	132	49	84	460	344	64	52
Testing, Inspection, Laboratory Service	338	2	1	–	1	11	8	1	2	39	28	9	2	84	74	9	1	202	184	15	3
Other (Including Medical Diagnosis, Treatment)	396	3	2	–	1	19	13	6	–	47	32	12	3	74	65	7	2	233	202	28	3
Total	4,856[1]	46	26	5	15	357	189	72	96	811	449	194	168	1,288	775	227	286	2,374	1,798	337	239

[1] See Appendix 4 for groups excluded.

Table B-7 – Function by Sex, Those Employed in Engineering and Scientific Professions, 1959

Function	Number	Per Cent	Sex			
			Male		Female	
			Number	Per Cent	Number	Per Cent
Engineering						
Construction, Installation, Erection	893	100	893	100	–	–
Design	1,251	100	1,246	99	5	*
Executive, Administrative	1,881	100	1,880	99	1	*
Field Exploration	101	100	101	100	–	–
Production, Operation, Maint.	1,113	100	1,113	100	–	–
Research, Development	453	100	451	99	2	*
Sales, Service, Marketing, Purchasing	607	100	605	99	2	*
Teaching, Instructing, Extension Work	174	100	174	100	–	–
Testing, Inspection, Laboratory Services	214	100	214	100	–	–
Other (including medical diagnosis, treatment)	409	100	407	99	2	1
Total, Engineering	7,096[1]	100	7,084	99	12	*
Science						
Construction, Installation, Erection	21	100	21	100	–	–
Design	38	100	37	97	1	3
Executive, Administrative	707	100	706	99	1	*
Field Exploration	309	100	308	99	1	*
Production, Operation, Maint.	427	100	425	99	2	1
Research, Development	1,201	100	1,143	95	58	5
Sales, Service, Marketing Purchasing	275	100	275	100	–	–
Teaching, Instructing, Extension Work	856	100	805	94	51	6
Testing, Inspection, Laboratory Services	349	100	304	87	45	13
Other (including medical diagnosis, treatment)	250	100	227	91	23	9
Total Science	4,433[1]	100	4,251	96	182	4
Total Engineering and Science	11,529[1]	100	11,335	98	194	2

* Less than ½ percent of one.
[1] See Appendix 4 for groups excluded.

Table B-8 – Field of Employment Specialization by Sex and Level of Education, 1959

FIELD OF EMPLOYMENT SPECIALIZATION	SEX AND LEVEL OF EDUCATION										
	Total	Males					Females				
		Total	No Degree	Bachelor's	Master's	Doctor's	Total	No Degree	Bachelor's	Master's	Doctor's
		Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Engineering – Total	7,158	7,146	126	6,380	544	96	12	–	11	1	–
Aeronautical	174	174	5	134	30	5	–	–	–	–	–
Chemical	377	375	2	314	37	22	2	–	2	–	–
Civil	2,081	2,080	38	1,861	165	16	1	–	–	1	–
Electrical	1,714	1,707	26	1,579	90	12	7	–	7	–	–
Mechanical	1,713	1,712	33	1,539	135	5	1	–	1	–	–
Metallurgical	342	341	7	273	35	26	1	–	1	–	–
Mining	347	347	9	310	20	8	–	–	–	–	–
Petroleum	410	410	6	370	32	2	–	–	–	–	–
Science – Total	2,767	2,603	13	1,490	469	631	164	–	120	23	21
Biology	348	271	–	97	55	119	77	–	54	10	13
Chemistry	1,293	1,243	9	831	154	249	50	–	40	7	3
Geography	48	45	–	23	10	12	3	–	3	–	–
Geology	494	489	2	267	105	115	5	–	5	–	–
Mathematics	219	199	–	126	40	33	20	–	13	4	3
Physics and Engineering Physics	365	356	2	146	105	103	9	–	5	2	2
Agriculture	1,206	1,189	2	803	225	159	17	–	12	1	4
Architecture	503	498	14	439	39	6	5	–	3	2	–
Forestry	479	478	4	398	61	15	1	–	–	1	–
Veterinary Medicine	355	348	–	326	14	8	7	–	7	–	–
Other Scientific and Technical Fields	149	143	1	102	26	14	6	–	2	2	2
Field Not Stated	1,750	1,714	17	1,499	173	25	36	–	31	4	1
Total All Fields	14,367[1]	14,119	177	11,437	1,551	954	248	–	186	34	28

[1]See Appendix 4 for groups excluded.

Table C–1 – Field of Employment Specialization by Undergraduate Course, Scientific and Technical Professionals, 1959

FIELD OF EMPLOYMENT SPECIALIZATION	Total All Courses	UNDERGRADUATE COURSE: Engineering													Science													
		Total Engineering	Aeronautical	Chemical	Civil	Electrical	Engineering Physics	Forest	Geological	Mechanical	Metallurgical	Mining	Petroleum	Other Engineering	Total Science	Biology	Chemistry	General Science	Geology	Mathematics	Mathematics and Physics	Physics	Other Science	Agriculture	Architecture	Forestry	Veterinary Medicine	Non-Engineering, Non-Scientific
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Engineering – Total	7,158	6,737	57	591	1,965	1,550	118	25	50	1,512	190	416	48	215	338	1	89	115	34	7	40	30	22	51	4	26	–	2
Aeronautical	174	155	44	9	8	20	11	–	–	58	1	–	–	4	19	–	4	10	–	1	3	1	–	–	–	–	–	–
Chemical	377	333	–	298	5	3	–	–	–	14	7	2	–	4	35	–	29	2	–	–	–	–	4	9	–	–	–	–
Civil	2,081	2,024	1	25	1,732	50	–	22	6	88	7	56	–	37	25	–	1	15	1	–	1	3	4	11	1	20	–	–
Electrical	1,714	1,615	1	12	38	1,343	73	–	2	94	4	2	–	46	90	–	–	41	–	4	28	15	2	6	1	1	–	1
Mechanical	1,713	1,643	11	65	110	109	21	2	4	1,161	24	32	–	104	50	–	10	21	3	1	7	7	1	15	1	3	–	1
Metallurgical	342	290	–	61	10	7	5	–	2	21	144	34	1	5	51	–	21	14	4	–	–	3	9	1	–	–	–	–
Mining	347	316	–	4	11	2	1	1	25	4	2	263	–	3	28	1	3	6	17	1	–	–	–	1	–	2	–	–
Petroleum	410	361	–	117	51	16	7	–	11	72	1	27	47	12	40	–	21	6	9	–	1	1	2	8	1	–	–	–
Science – Total	2,767	675	2	363	28	32	64	2	95	22	12	43	1	11	1,891	143	536	411	224	88	187	117	185	176	–	10	4	11
Biological Sciences	348	4	–	2	–	–	–	–	–	2	–	–	–	–	265	127	24	69	–	1	–	4	40	64	–	7	3	5
Chemistry	1,293	401	–	348	12	5	2	–	–	12	12	6	–	4	789	8	499	188	3	–	4	1	86	97	–	1	–	5
Geography	48	6	–	1	1	1	–	2	1	–	–	–	–	–	41	–	–	12	1	–	1	–	27	1	–	–	–	–
Geosciences	494	163	–	3	9	9	9	–	94	1	–	35	1	2	328	6	6	59	220	3	12	10	12	3	–	–	–	–
Mathematics	219	20	–	2	3	6	3	–	–	2	–	2	–	2	196	–	1	37	–	67	82	5	4	3	–	–	–	–
Physics and Eng. Physics	365	81	2	7	3	11	50	–	–	5	–	–	–	3	272	2	6	46	–	17	88	97	16	8	–	2	1	1
Agriculture	1,206	39	–	2	5	2	1	1	–	6	–	3	–	19	91	48	15	17	2	–	–	–	9	1,062	1	8	3	2
Architecture	503	112	–	10	60	10	–	1	–	22	–	3	–	6	15	–	1	5	–	–	3	–	6	9	362	4	–	1
Forestry	479	114	–	3	7	4	–	94	–	4	–	–	–	2	8	4	1	3	–	–	–	–	–	11	–	346	–	–
Veterinary Medicine	355	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	2	–	–	–	–	1	2	–	–	350	–
Other Scient. and Tech. Fields	149	81	–	25	3	17	10	2	1	12	3	3	–	5	50	3	12	14	1	3	6	3	8	15	–	2	1	–
Fields Not Stated	1,750	921	5	148	173	186	10	9	4	235	33	64	1	53	450	22	78	219	19	17	41	13	41	296	14	55	12	2
Total, All Fields	14,367[1]	8,679	64	1,142	2,241	1,801	203	134	150	1,813	238	532	50	311	2,846	221	732	786	280	115	277	163	272	1,622	381	451	370	18

[1] See Appendix 4 for groups excluded.

Table C–2 – Location of Undergraduate University and Place of Employment by Years From Bachelor Graduation, Engineering and Science, 1959

Location of Undergraduate University	Total	Place of Employment and Years From Bachelor Graduation									
		Atlantic		Quebec		Ontario		Prairies		Pacific	
		Before 1949	1949 – 1958	Before 1949	1949 – 1958	Before 1949	1949 – 1958	Before 1949	1949 – 1958	Before 1949	1949 – 1958
		Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Engineering											
Canada – Total	7,863	160	220	1,013	1,031	1,760	1,929	378	709	310	353
Atlantic	645	118	176	59	81	83	89	12	15	2	10
Quebec	1,626	13	10	563	668	163	149	17	17	15	11
Ontario	3,227	18	22	252	186	1,218	1,347	47	68	39	30
Prairies	1,619	10	7	106	68	234	243	280	542	76	53
Pacific	746	1	5	33	28	62	101	22	67	178	249
United States	210	2	–	47	5	72	27	21	9	26	1
United Kingdom	211	6	2	34	16	75	36	10	9	16	7
Other Countries	236	4	1	84	15	80	8	19	2	20	3
Total, Engineering	8,520	172	223	1,178	1,067	1,987	2,000	428	729	372	364
Science											
Canada – Total	4,607	152	163	483	401	1,033	902	416	559	218	280
Atlantic	476	90	91	43	42	80	75	15	26	3	11
Quebec	933	38	54	324	292	82	102	13	14	7	7
Ontario	1,594	17	14	73	52	712	607	40	44	23	12
Prairies	1,078	6	2	33	9	123	81	334	440	31	19
Pacific	526	1	2	10	6	36	37	14	35	154	231
United States	63	1	–	7	–	15	6	14	5	13	2
United Kingdom	99	3	1	12	12	35	15	5	2	13	1
Other Countries	92	2	–	28	5	22	8	15	1	8	3
Total, Science	4,861	158	164	530	418	1,105	931	450	567	252	286
Total, Engineering & Science	13,381[1]	330	387	1,708	1,485	3,092	2,931	878	1,296	624	650

[1]See Appendix 4 for groups excluded.

Table C-3 – Function by Undergraduate Course, Those Employed in Engineering Fields, 1959

THOSE EMPLOYED IN ENGINEERING FIELDS	Total All Courses	UNDERGRADUATE COURSE: Engineering: Total Engineering	Aeronautical	Chemical	Civil	Electrical	Engineering Physics	Forest	Geological	Mechanical	Metallurgical	Mining	Petroleum	Other	Science: Total Science	Biology	Chemistry	General Science	Geology	Mathematics	Mathematics and Physics	Physics	Other Sciences	Agriculture	Architecture	Forestry	Veterinary Medicine	Non-Engineering and Non-Scientific
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Function																												
Construction, Installation, Erection	893	865	2	14	507	119	5	4	3	129	5	45	3	29	13	–	–	7	–	–	3	3	–	8	–	7	–	–
Design	1,251	1,203	9	61	383	329	21	–	–	350	5	23	2	20	41	–	2	25	2	–	7	5	–	4	1	2	–	–
Executive, Administrative	1,881	1,779	12	122	606	427	23	9	13	337	38	123	10	59	83	1	25	19	11	2	12	7	6	11	1	5	–	2
Field Exploration	101	84	–	4	30	3	2	–	12	–	2	28	2	1	13	–	1	3	9	–	–	–	–	1	1	2	–	–
Production, Operation, Maintenance	1,113	1,064	9	181	133	215	14	3	13	278	50	104	21	43	43	–	16	17	2	–	2	2	4	6	–	–	–	–
Research, Development	453	392	14	79	43	87	27	–	4	69	38	22	–	9	58	–	22	16	5	2	2	3	8	3	–	–	–	–
Sales, Service, Marketing, Purchasing	607	580	2	39	71	185	9	–	2	197	23	23	1	28	17	–	2	6	1	–	4	4	–	9	–	1	–	–
Teaching, Instructing, Extension Work	174	154	1	16	41	34	1	–	–	47	1	7	1	5	20	–	6	5	–	–	6	2	1	–	–	–	–	–
Testing, Inspection, Laboratory Services	214	187	6	42	37	42	5	–	–	23	19	8	–	5	21	–	8	8	1	1	1	1	1	4	–	2	–	–
Other (Includes Medical Diagnosis)	409	369	2	31	90	98	11	8	2	70	7	29	7	14	29	–	7	9	3	2	3	3	2	4	1	6	–	–
Not Stated	62	60	–	2	24	11	–	1	1	12	2	4	1	2	–	–	–	–	–	–	–	–	–	1	–	1	–	–
Total, Engineering	7,158[1]	6,737	57	591	1,965	1,550	118	25	50	1,512	190	416	48	215	338	1	89	115	34	7	40	30	22	51	4	26	–	2

[1] See Appendix 4 for groups excluded.

Table C-4 – Function by Undergraduate Course, Those Employed in Science Fields, 1959

THOSE EMPLOYED IN SCIENCE FIELDS	Total All Courses	UNDERGRADUATE COURSE: Engineering: Total Engineering	Aeronautical	Chemical	Civil	Electrical	Engineering Physics	Forest	Geological	Mechanical	Metallurgical	Mining	Petroleum	Other	Science: Total Science	Biology	Chemistry	General Science	Geology	Mathematics	Mathematics and Physics	Physics	Other Sciences	Agriculture	Architecture	Forestry	Veterinary Medicine	Non-Engineering and Non-Scientific
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Function																												
Construction, Installation Erection	21	10	–	–	4	1	–	3	–	1	1	–	–	–	1	–	–	–	–	–	–	1	–	7	–	3	–	–
Design	38	29	–	9	4	3	7	1	–	2	–	1	–	2	4	–	1	1	–	1	1	–	–	3	–	2	–	–
Executive, Administrative	707	171	–	68	16	14	6	28	17	8	1	7	–	6	237	17	76	36	37	8	31	11	21	163	–	131	–	5
Field Exploration	309	98	–	3	4	4	3	13	52	1	–	17	–	1	162	1	1	41	106	2	2	3	6	20	–	29	–	–
Production, Operation, Maintenance	427	134	–	82	5	4	4	17	8	7	3	2	–	2	104	1	41	24	17	2	5	5	9	110	–	78	–	1
Research, Development	1,201	179	2	100	2	7	27	14	13	4	1	6	–	3	646	99	237	89	36	17	45	53	70	305	–	64	4	3
Sales, Service, Marketing, Purchasing	275	65	–	43	1	–	1	5	–	5	3	3	1	3	72	3	28	29	1	1	3	3	4	129	–	9	–	–
Teaching, Instructing, Extension Work	856	62	–	16	2	5	10	8	1	3	–	4	–	13	450	58	72	103	13	51	74	28	51	319	1	21	–	3
Testing, Inspection, Laboratory Services	349	48	–	40	–	–	1	3	–	–	3	–	–	1	195	10	82	74	–	–	3	1	25	102	–	2	1	1
Other (Includes Medical Diagnosis)	250	28	–	6	2	–	5	5	3	1	–	5	–	1	114	6	13	33	14	6	22	12	8	84	–	22	2	–
Not Stated	19	4	–	1	–	–	1	–	1	–	–	1	–	–	5	–	1	1	2	–	1	–	–	7	–	3	–	–
Total, Science	4,452[1]	828	2	368	40	38	65	97	95	32	12	46	1	32	1,990	195	552	431	226	88	187	117	194	1,249	1	364	7	13

[1]See Appendix 4 for groups excluded.

Table D–1 – Country of Birth by Level of Education and Years from Bachelor Graduation, Engineering and Science, 1959

Country of Birth and Level of Education[1]	Total Engineering and Science	Engineering						Science					
		Total	Years from Bachelor Graduation					Total	Years from Bachelor Graduation				
			Over 40	31–40	21–30	11–20	1–10		Over 40	31–40	21–30	11–20	1–10
		Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Canada – Total	11,168	7,018	113	449	1,006	1,795	3,655	4,150	29	254	696	1,101	2,070
Bachelor's	9,248	6,399	106	406	893	1,615	3,379	2,849	18	155	397	696	1,583
Master's	1,200	505	5	30	90	139	241	695	2	44	164	191	294
Doctor's	720	114	2	13	23	41	35	606	9	55	135	214	193
United States – Total	354	233	15	55	44	44	75	121	8	20	33	32	28
Bachelor's	279	208	14	47	40	42	65	71	6	9	20	17	19
Master's	46	22	1	7	4	2	8	24	1	7	6	5	5
Doctor's	29	3	–	1	–	–	2	26	1	4	7	10	4
United Kingdom	624	394	15	70	87	103	119	230	7	45	52	58	68
Bachelor's	452	343	12	56	77	86	112	109	2	16	23	25	43
Master's	88	43	2	12	8	15	6	45	2	13	12	7	11
Doctor's	84	8	1	2	2	2	1	76	3	16	17	26	14
Other Countries – Total	858	571	8	74	118	139	232	287	2	40	31	90	124
Bachelor's	581	435	6	51	76	104	198	146	–	11	11	35	89
Master's	162	105	2	15	33	27	28	57	–	9	9	20	19
Doctor's	115	31	–	8	9	8	6	84	2	20	11	35	16
Total, All Countries	13,004[2]	8,216	151	648	1,255	2,081	4,081	4,788	46	359	812	1,281	2,290

[1]See Appendix 2 for explanation of level of education groups.
[2]See Appendix 4 for groups excluded.